Anatomy Hand - out

PELVIS

BY
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anatomy hand-out

PELVIS AND PERINEUM

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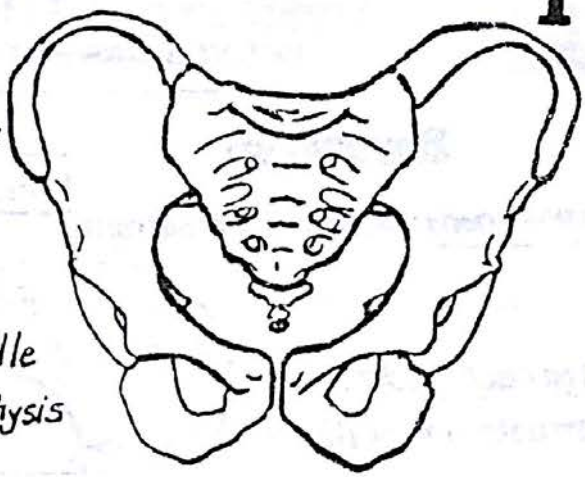
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Index of Contents

	Page
(1) Bony Pelvis	1-6
(2) Walls of the true pelvis	7
(3) Joints of the pelvis	8
(4) Muscles of the pelvis	9-12
(5) Pelvic fascia	12
(6) Pelvic peritoneum	13
(7) Rectum	14-17
(8) Anal Canal	18-20
(9) Urinary bladder	21-24
(10) Male urethra	25-27
(11) Female urethra	27
(12) Prostate	28-29
(13) Vas deferens, Seminal vesicles & ejaculatory ducts	30-31
(14) Penis	31-32
(15) Ovary	33-34
(16) Fallopian tubes & Uterus	35-42
(17) Vagina	43-44
(18) Perineum	45
(17) Ischio-rectal fossa	46-48
(18) Perineal pouches	49-52
(19) Perineal membrane & perineal body	53-54
(20) Differences between male & female perineum	55
(21) Internal pudenda artery & pudendal nerve	56-57
(22) Arteries of the pelvis	58-63
(23) Nerves of the pelvis	63-64

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Bony Pelvis



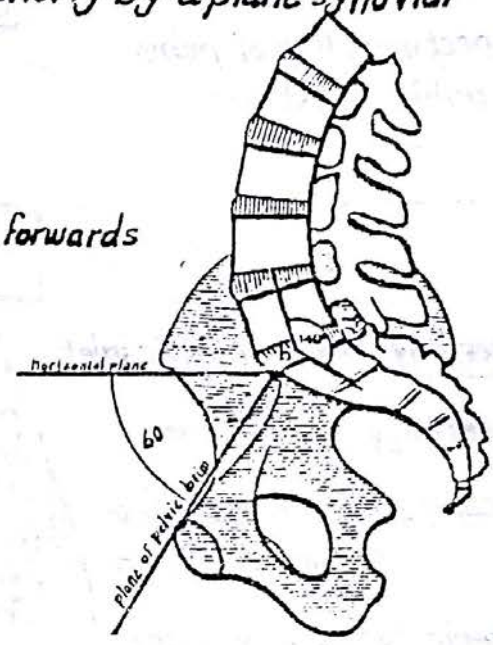
I-Structure: the bony pelvis is composed of:

(1) the 2 hip bones: anteriorly & laterally.

(2) the Sacrum & Coccyx: posteriorly.

- The 2 hip bones articulate together in the middle line anteriorly by 2ry Cartilagenous joint (Symphysis pubis
- each hip bone articulates with the sacrum posteriorly by a plane synovial joint (Sacroiliac joint).

II- Position of the pelvis:

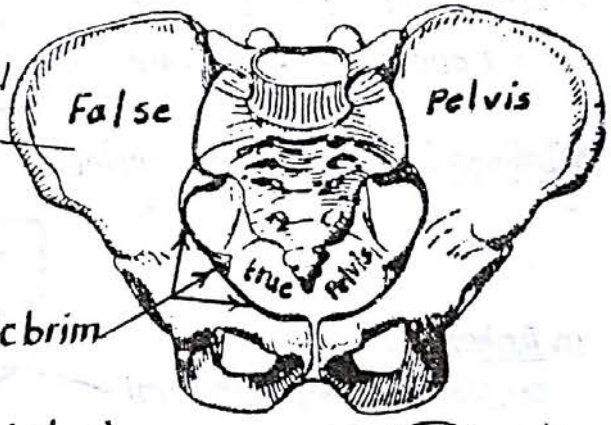


- in the erect anatomical position, the pelvis is tilted forwards so that:

(1) the plane of the pelvic brim makes an angle of 60° with the horizontal plane.

(2) the ant. sup. iliac spine & the upper border of the symphysis pubis lie in the same vertical plane.

III- Divisions of the Pelvis:



(1) Greater pelvis (false pelvis): lies above the level of the pelvic brim. It is bounded by iliac fossa on each side & its cavity forms the lower part of the abdominal cavity proper.

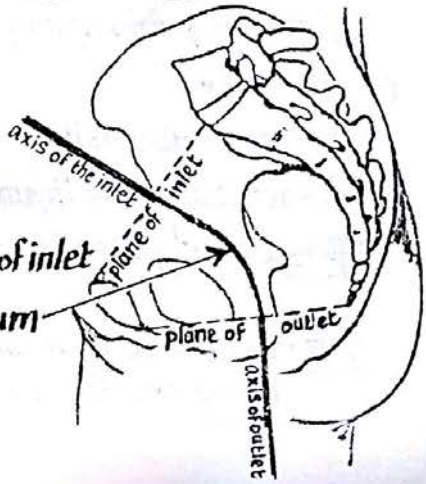
(2) Lesser (true) pelvis: lies below the level of Pelvic brim & is bounded by:

(a) symphysis pubis, pubic bodies & rami (in front & below).

(b) pelvic surface of sacrum & coccyx (behind & above).

(c) pelvic surface of ilium & ischium (on each side).

IV- Axes of the pelvis:



(1) axis of inlet: is a line perpendicular to the middle of the plane of inlet

(2) axis of pelvic cavity: is a line parallel to the curve of the sacrum

(3) axis of the outlet: is a line perpendicular to the middle of the plane of the pelvic outlet

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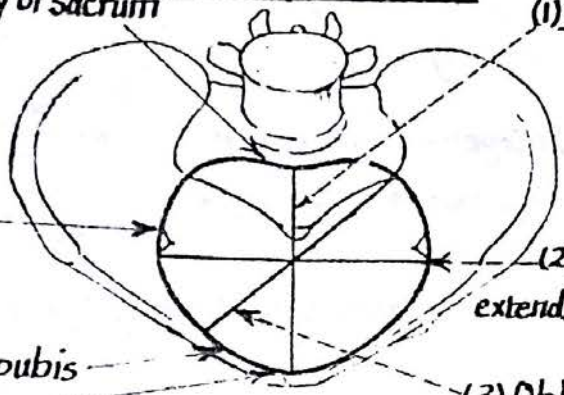
PELVIC INLET

Boundaries

(1) posteriorly: promontary of sacrum

(2) on each side: arcuate line of ilium

(3) Anteriorly:
- (a) pectineal line of pubis
- (b) pubic crest



Diameters

(1) anteroposterior (true conjugate) diameter (11 cm in female): it extends from promontary of sacrum to upper border of the symphysis pubis.

(2) transverse diameter (13 cm in ♀) - extends between the farthest points of the arcuate lines.

(3) Oblique diameter ($12\frac{1}{2}$ cm in ♀) extends from sacroiliac joint of one side to the iliopubic eminence of the opposite side

PELVIC CAVITY

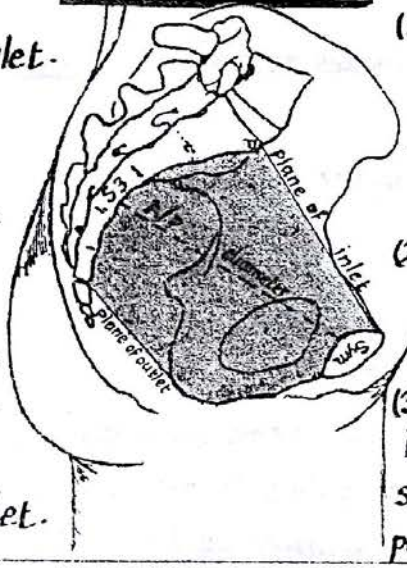
(1) Superiorly: plane of pelvic inlet.

(2) posteriorly: the sacrum.

(3) on each side: pelvic surface of ilium & ischium

(4) anteriorly: Symphysis pubis, the 2 pubic rami & obturator foramina

(5) Inferiorly: plane of pelvic outlet.



(1) antero posterior diameter (13 cm in ♀) - extends from midpoint of back of the symphysis pubis to the midpoint of the 3rd sacral piece.

(2) transverse diameter (12·5 cm in ♀) is the widest transverse distance between the 2 side walls of the pelvis.

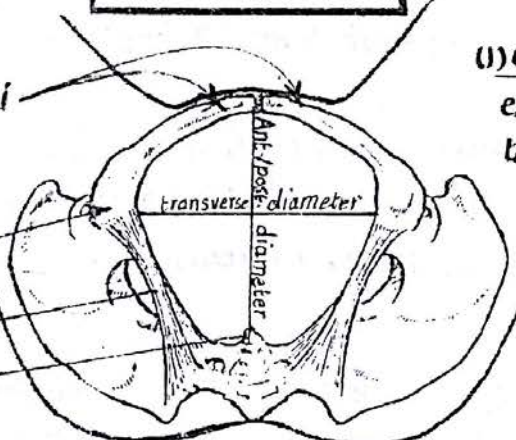
(3) oblique diameter (12 cm in ♀): it extends from the lowest point of the sacroiliac joint of one side to the mid-point of the obturator F. of the opposite side

PELVIC OUTLET

(1) Anteriorly: conjoined ischiopubic rami & inferior pubic ligament

(2) Laterally:
- (a) ischial tuberosity
- (b) sacrotuberous ligament

(3) posteriorly: tip of coccyx



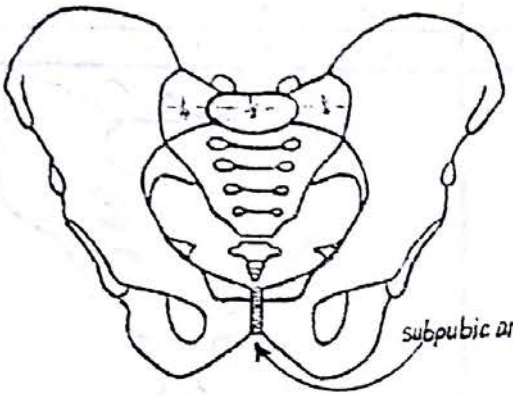
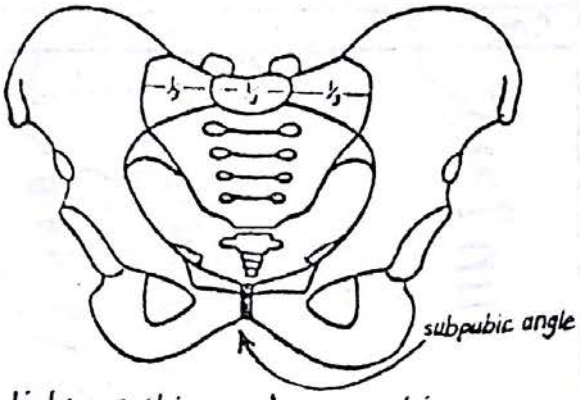
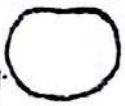
(1) anteroposterior (12 cm in ♀): extends from the apex of coccyx to the lower border of symphysis pubis

(2) transverse (11 cm in ♀): extends transversely between the 2 ischial tuberosities

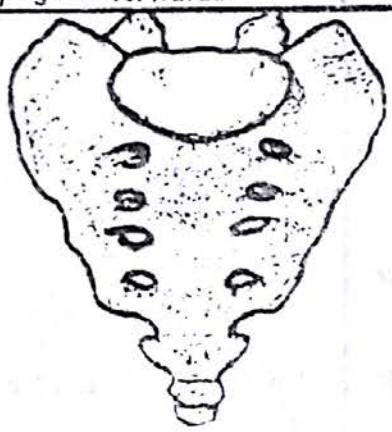
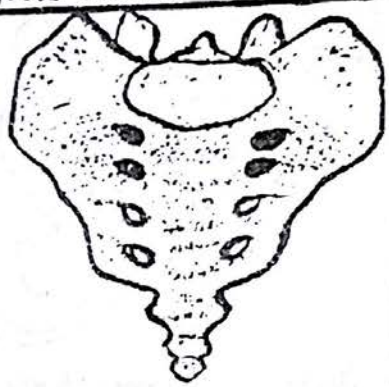
N.B: the above mentioned diameters are peculiar to the female pelvis. The male pelvis has shorter diameters.

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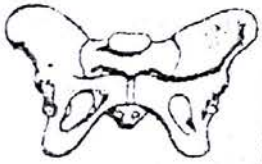
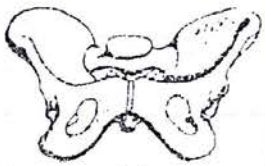
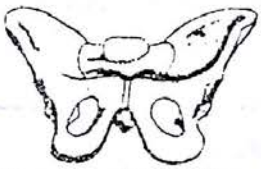
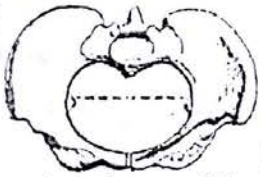
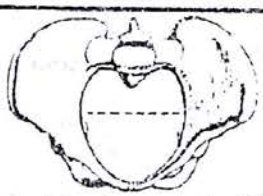
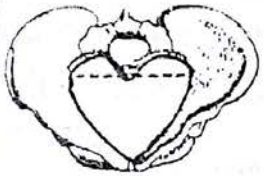
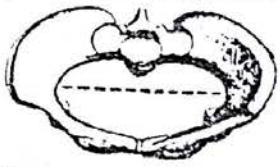
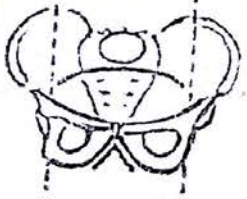
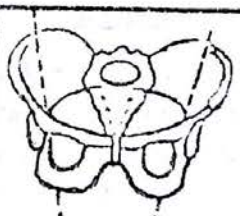
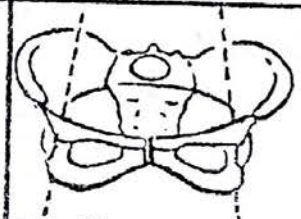
Differences between the Male & Female Pelvis

		Male Pelvis	Female Pelvis
			
1-	general differences	heavier & stronger; bony markings are more prominent.	lighter & thinner; bony markings are less prominent.
2-	Joint surfaces	larger	smaller
	a- lumbo-sacral joint	the articular surface on the base of sacrum equals ½ the base.	the articular surface on the base of sacrum equals 1/3 of the base
	b- sacro-iliac joint	the auricular surface of ilium articulates with 2½ pieces of sacrum.	the auricular surface of ilium articulates with 2 segments only of sacrum.
	c- hip joint	the acetabulum is larger & its width is equal to the distance from its ant. margin to the symphysis pubis	the acetabulum is smaller & its width is less than the distance from its ant. margin to the symphysis pubis.
	d- symphysis pubis	is relatively long	is relatively short.
3-	False pelvis	deep	shallow
4-	A.S.I.S.	inverted	everted
5-	Pelvic inlet	* heart-shaped because the sacral promontary projects more forwards  * all its diameters are less than ♀ by 1 cm	* oval or rounded because the sacral promontary is less projecting  * all diameters are greater than ♂ (see p. 2).
6-	Pelvic cavity	deep & funnel-shaped (long segment of short cone). 	shallow & tubular (short segment of a long cone). 
7-	Pelvic outlet	narrower because: (1) the subpubic angle is acute (2) the ischiopubic rami are thick & everted (for the attachment of the crus of the penis) (3) the ischial tuberosities are less everted (4) greater sciatic notches are narrow & deep (5) all its diameters are shorter: (a) A/P diameter (8 cm) (b) tr. diameter (8 cm)	Wider because: (1) the subpubic angle is obtuse. (2) the ischiopubic rami are thin & not everted (3) the ischial tuberosities are more everted. (4) the greater sciatic notches are shallow & wide (5) all its diameters are longer: (a) A/P diameter: 12 cm (b) tr. diameter: 11 cm

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	Male Pelvis	Female Pelvis
pre-auricular sulcus	less marked	deep preauricular sulcus
ischial spines	more inverted	less inverted
coccyx	projects forwards	projects downwards
Sacrum		
(a) size	longer & narrower.	shorter & broader.
(b) curve	pelvic surface is more curved.	pelvic surface is less curved.
(c) body of S1	makes 1/3 of the base of sacrum	makes only 1/4 of breadth of the base
(d) auricular surface	Covers 2½-3 sacral segments (more stable sacrum)	Covers 2 sacral segments only (more movable sacrum)

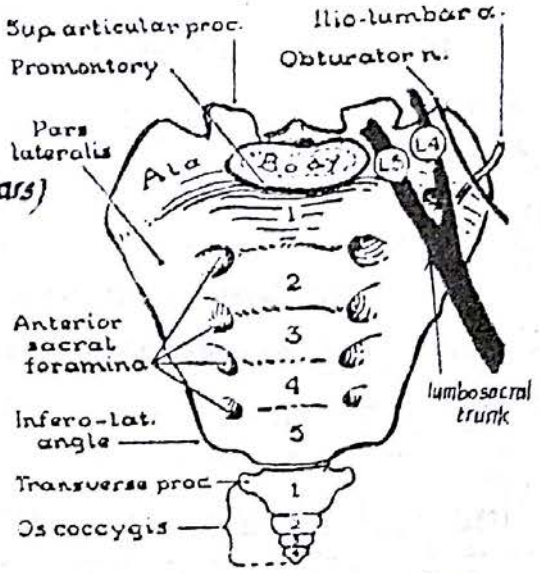
Types of female pelvis

	1- Gynaecoid (50%)	2- Anthropoid (25%)	3- Android (20%)	4- Platypelloid (5%)
General features	 it is the classical female type	 it resembles the ape pelvis	 it resembles the male pelvis	 it is a flat type of pelvis
pelvic inlet	 oval in shape with the tr. diameter longer than the A/P diameter.	 oval in shape but with A/P. diameter greater than the tr. diameter	 typically heart-shaped	 is contracted from before backwards with great tr. than A/P diameter
Pelvic cavity	 wide & shallow with parallel side walls	 deep cavity with parallel side walls.	 funnel-shaped deep cavity with convergent side walls.	 shallow cavity with divergent side walls.

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Sacrum

* It is a triangular bone formed of 5 sacral vertebrae which are fused together (12-25 years)
* It has:
 - Base: directed upwards
 - Apex: // downwards
 - ant. (pelvic) surface
 - post. (dorsal) surface
 - 2 lateral masses



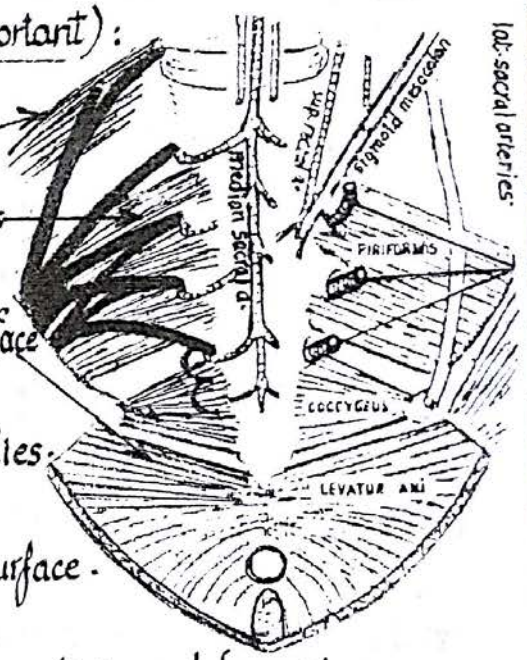
Pelvic (anterior) aspect of sacrum

(1) **The base**: (formed by the 1st sacral vertebra):
- the ant. border of the body of S_1 is called the **sacral promontary**
- the lat. part of the base on each side of the body is called "**ala of sacrum**" it is related to Psoas major, obturator n. & the lumbosacral trunk
- the articular surface of the body articulates with L_5 vertebra (lumbosacral joint)

(2) **The apex**: is directed downwards & articulates with the coccyx.

(3) **The ant. (pelvic) surface**: is concave, smooth, formed by the fused bodies of the sacral vertebrae & shows 4 pairs of ant. sacral foramina.

* Relations of the ant. surface of sacrum (very important):



(A) Muscles: 3
1) iliacus m. : arises from lat. part of the ala
2) piriformis: // // the middle 3 sacral peices
3) the Coccygus m. & the ischiococcygus part of levator ani: inserted into the lower part of ant. surface

(B) Ligaments: 3
1) ant. longitudinal lig.: attached to the front of sacral bodies
2) lumbosacral lig.: attached to the ala.
3) ant. sacroiliac lig.: // to the lat. part of the ant. surface.

(C) Nerves: 3
1) the 2 sympathetic chains: descend med. to the ant. sacral foramina.
2) Lumbosacral trunk: crosses infront of the ala med. to obturator n.
3) Ant. 1ry rami of sacral nerves: emerge from the ant. sacral foramina.

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(D) Vessels : 3

1) median sacral vessels : in the median plane .
2) the lateral sacral vessels : entering the ant. sacral foramina .
3) the Sup. rectal vessels : lying within concavity of bone .

(E) Viscera : 3

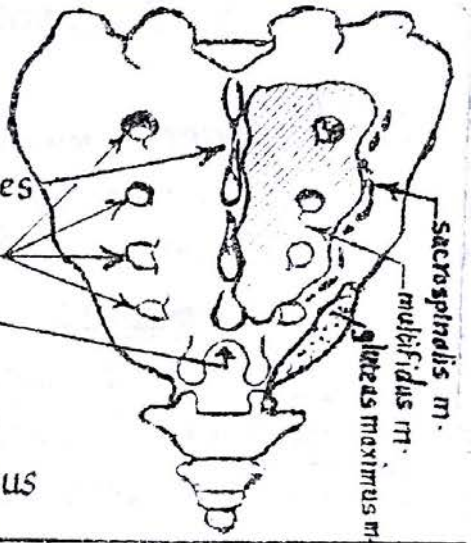
1) Pelvic mesocolon :- its med. limb is attached to the upper 2 sacral vertebrae .
2) Pelvic colon : related to the upper 2 sacral vertebrae
3) Rectum : lies infront of the lower 3 " "

* The post. surface of Sacrum :

convex & shows the following features :

1) Median sacral crest produced by fused spinous processes
2) 4 pairs of dorsal sacral foramina
3) Sacral hiatus : at the lower end of Sacral canal

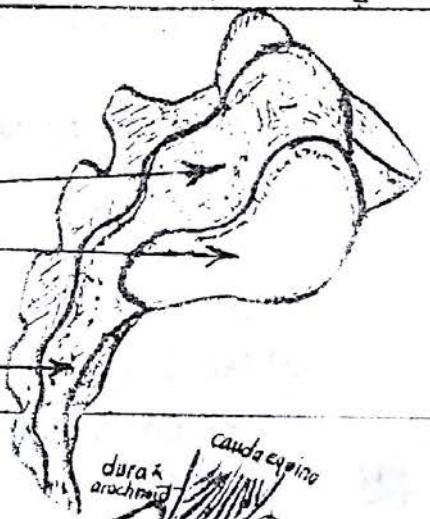
• Muscles attached to the post. surface ←→ 1) Multifidus m.
2) Sacrospinalis m.
3) Gluteus maximus



* The lateral surface :

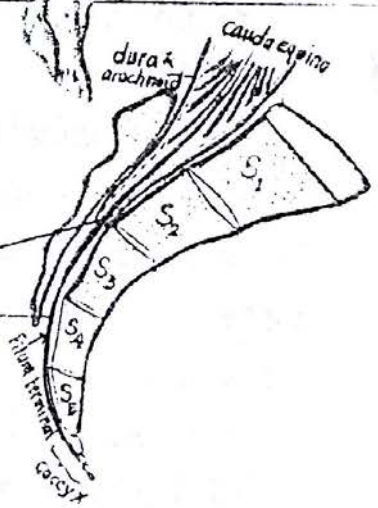
triangular in shape & shows the following features :

1) rough area for attachment of interosseous sacroiliac lig.
2) auricular surface for articulation with the ilium
3) narrow lower part for the attachment of the sacrotuberous & the sacrospinous ligaments



*Contents of the Sacral canal :

(1) Cauda equina : the roots of the sacral & Coccygeal nerves .
(2) the dura & arachnoid mater extending into the sacral canal as far as the 2nd sacral vertebra
(3) the filum terminal : a prolongation of the pia mater
(4) lateral sacral arteries & the internal vertebral venous plexus .
(5) Loose areolar C.T.



* Sex differences of the Sacrum : see page 4 .

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Walls of the true pelvis

The pelvic walls are formed of a framework of bones, ligaments, joints & membranes which are lined by muscles

* **Bones** : 2 hip bones, sacrum & coccyx.
* **Ligaments** : sacrotuberous, sacrospinous & iliolumbar lig. (on each side).
* **Joints** : Rt. & Lt. sacroiliac joints, symphysis pubis & sacroiliac joint
* **Membranes** : obturator membrane (one on each side) & perineal membrane
* **Muscles** :- piriformis : on the post. wall (one on each side)
 - Obturator internus : on the anterolateral wall (one on each side).
 - levator ani & coccygeus : forming the pelvic floor inferiorly.

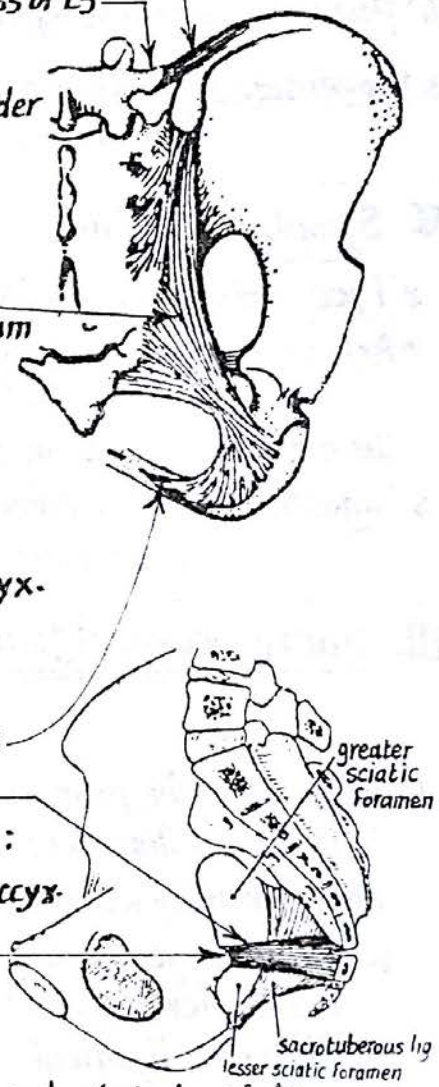
Ligaments of the pelvis

(1) Iliolumbar ligament :

- it is a strong triangular lig. extending from the transverse process of L5 to the post. part of the inner lip of iliac crest.
- **Function** : (a) prevents the antero-inferior slipping of L5 vertebra under the effect of body weight.
 (b) it prevents forward movement at the sacro-iliac joint.

(2) Sacro tuberous ligament :

- it is a strong band which bridges the gap between the hip bone & sacrum & forms part of the boundaries of pelvic outlet & the sciatic foramina.
- **Shape & attachments** : it is triangular in shape having :
 - **Base** (superomedial end) : attached to :
 - post. sup. & post. inf. iliac spines.
 - lat. margin of the lower part of sacrum & upper part of coccyx.
 - **Apex** (inferolateral end) : attached to :
 - medial edge of ischial tuberosity
 - to ischial ramus by an extension called falciform process



(3) Sacro Spinous ligament :

it is a thin triangular lig. lying deep to the sacrotuberous lig. & having :

- **Base** (med. end) : attached to the last piece of sacrum & 1st piece of coccyx.
- **Apex** (lat. end) : attached to the ischial spine

N.B: the pelvic surface of the lig. is covered by the coccygeus muscle.

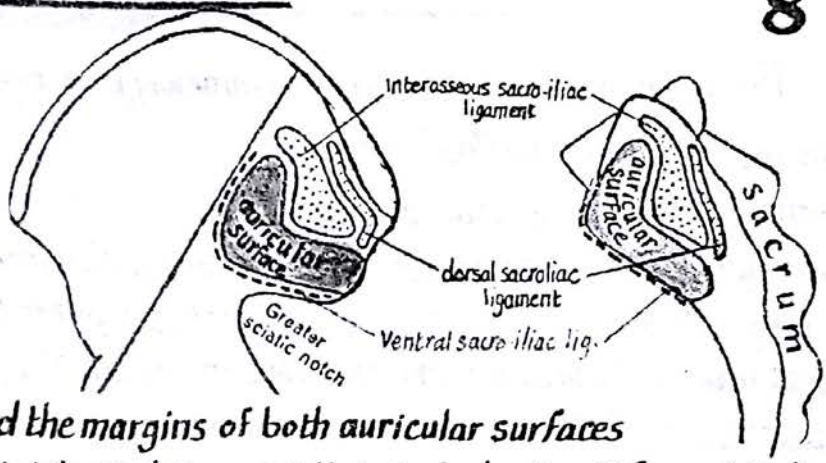
* **Functions of the sacrospinous & sacrotuberous ligaments** :

(1) binding the sacrum & coccyx to hip bone & preventing their upward tilt under the body weight.
(2) they form boundaries to the greater & lesser sciatic foramina.
(3) the sacrotuberous lig. forms the posterolateral boundary of the perineum.
(4) the sacrotuberous lig. gives origin to gluteus maximus m. & sacrospinous lig. gives origin to coccygeus m.

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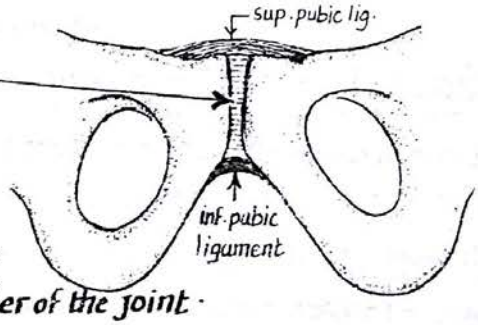
Joints of the pelvis

I- Sacro-iliac joint :



* **Type:** plane synovial joint
* **Articular surfaces :**
 (1) the auricular surface of sacrum
 (2) the auricular surface of ilium
* **Capsule & ligaments**
 (1) **Fibrous capsule** : attached around the margins of both auricular surfaces
 (2) **Interosseous sacro-iliac ligament** (the 2nd strongest lig in the body after iliofemoral lig.) : it is attached between : (a) iliac tuberosity of the hip bone (behind the auricular surface). (b) the depression behind the auricular surface of sacrum).
 (3) **Anterior sacro-iliac lig.** : Connects the ventral convex margins of both auricular surfaces. It indents a pre-auricular surface in the hip bone (deeper in females).
 (4) **Posterior sacro-iliac lig.** : connects the post. sup. iliac spine to the lat. crest of the sacrum.
* **Movements** : it allows a small amount of anteroposterior rotatory movements around a transverse axis passing 5-10 cm below the sacral promontary.

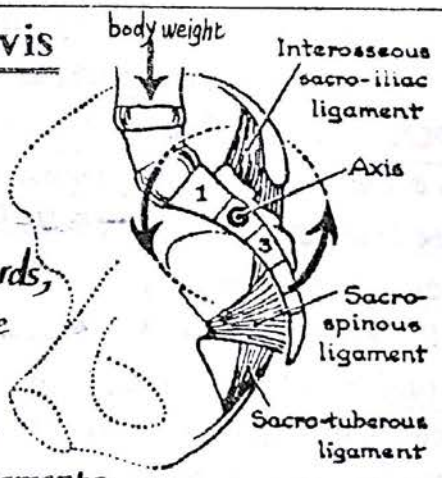
II- Symphysis pubis :



* **Type** : secondary cartilagenous joint.
* **Articular surfaces** : the symphyseal surfaces of the Rt. & Lt. pubic bodies (covered by hyaline cartilages)
* the articular surfaces are connected by disc of fibrocartilage.
* **Ligaments** : (1) sup. pubic lig. : extends along the upper border of the joint.
 (2) inf. pubic (arcuate) lig. : arches along the lower border of the joint

III- Sacrococcygeal Joint : is a 2ry cartilagenous joint between the sacrum & coccyx.

Mechanism of the pelvis

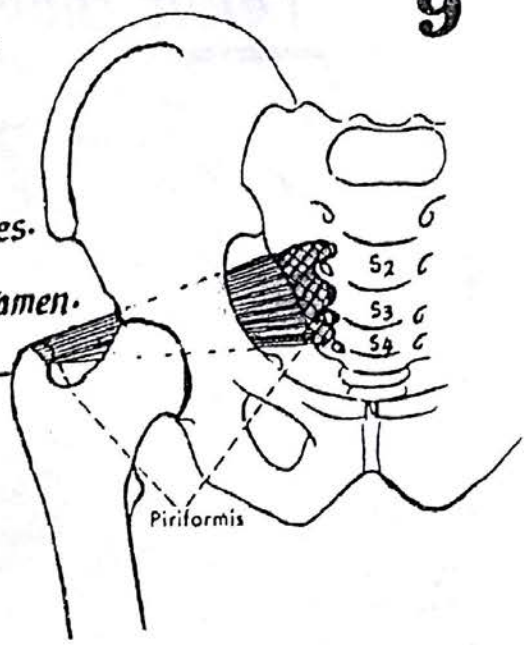


(1) Because of the poor locking of the articular surfaces in the sacro-iliac joint, the sacrum is forced to rotate under the body weight so that :
 (a) the upper segment of the sacrum tends to tilt downwards, this is prevented by the interosseous sacro-iliac & the iliolumbar ligaments
 (b) the lower segment of the sacrum tends to tilt upwards, this is prevented by the sacrotuberous & sacrospinous ligaments.
(2) during all these movements the separation of the 2 hip bones is prevented by the sacro-iliac and iliolumbar ligaments, and the ligaments of the symphysis pubis.

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Muscles of pelvic Walls

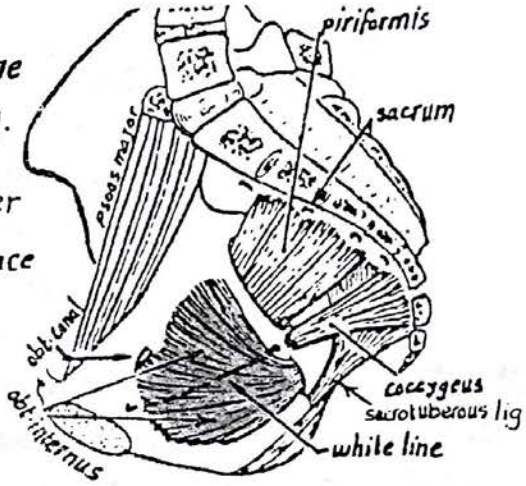
1- Piriformis m.



Origin: from the ant. surface of the middle 3 sacral pieces.
It leaves the pelvis by passing through greater sciatic foramen.

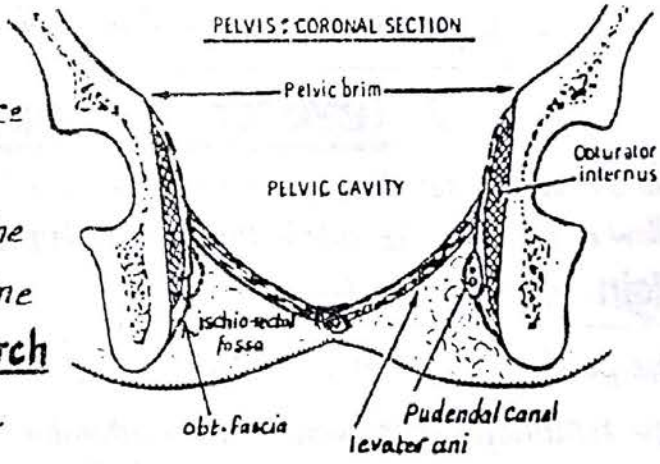
* **Insertion**: into the upper border of greater trochanter of femur.
* **N. supply**: branches from the sacral plexus (S1, S2).
* **Action**: lat. rotation of the thigh.
* **Pelvic relations**: it is related anteriorly to: (1) roots of the sacral plexus (2) rectum.

2- Obturator internus m.



* **Origin**: From the inner surface of the obturator membrane + the adjoining part of the ant. & lat. pelvic wall.
* **Insertion**: its tendon leaves the pelvis through the lesser sciatic foramen to be inserted into the med. surface of the greater trochanter of femur.
* **N. supply**: n. to obturator internus (from sacral plexus).
* **Action**: lateral rotator of the thigh.

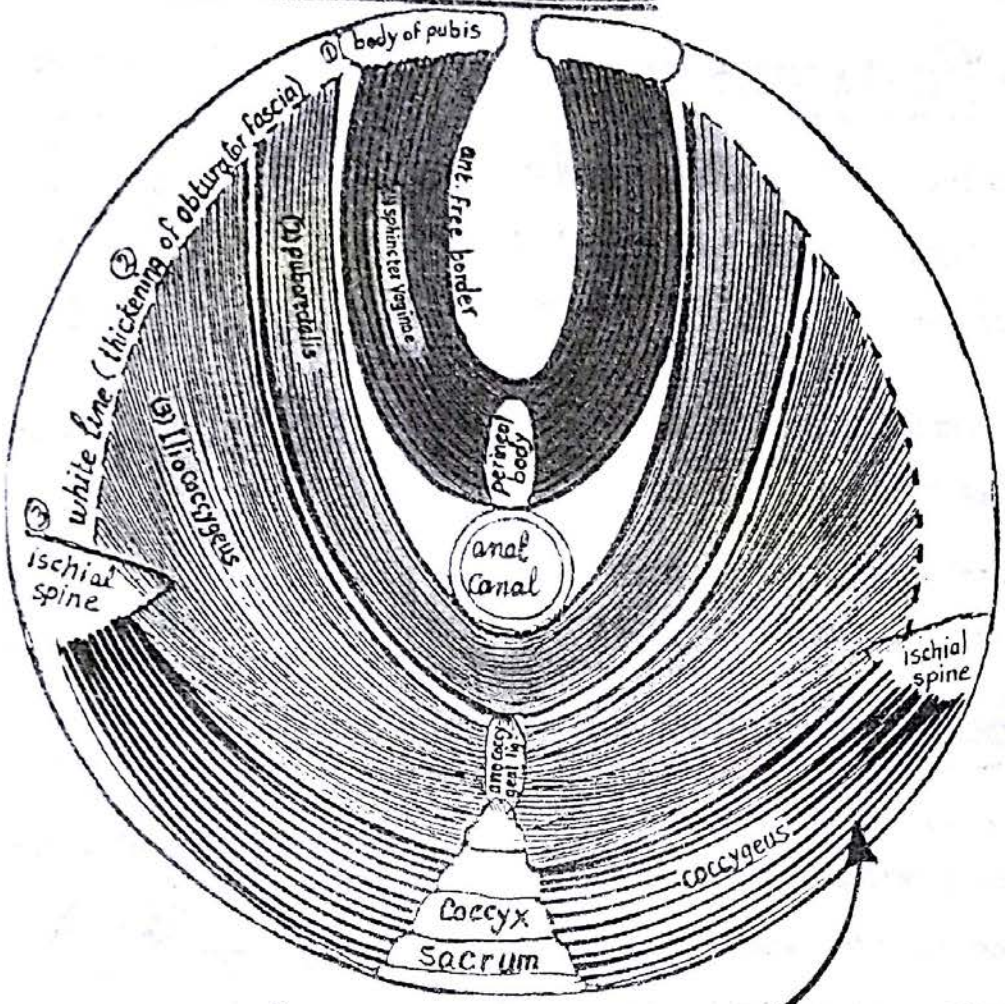
Obturator fascia



- it is the deep fascia covering the pelvic surface of obturator internus m.
- it shows a thickened line extending from the back of pubis to the ischial spine. This line is called **the White line or tendinous arch** which gives origin to the levator ani muscle.
- above the tendinous arch, the obturator fascia is thick
- below the " " , the obturator fascia is thin & forms the lat. wall of the ischio-rectal fossa. Here the obturator fascia splits into 2 layers forming the **pudendal canal** (for the pudendal n. & internal pudendal vessels). : see page 48

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Pelvic diaphragm (levator ani & coccygeus)



1- Coccygeus m.

* **Origin**: from the inner surface of the ischial spine.
* **Insertion**: into the last piece of sacrum & 1st piece of coccyx.
* **N. supply**: branches from S 4,5.
* **Action**: it supports the coccyx during defaecation or labour.

2- levator ani muscle

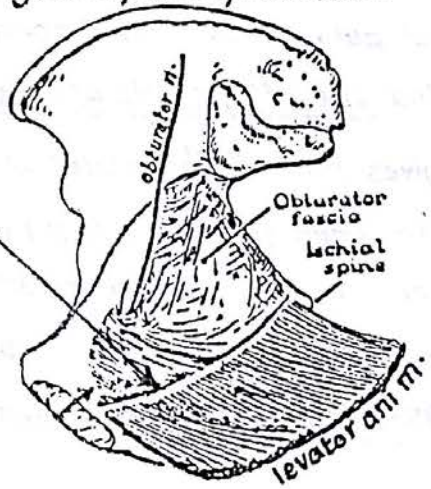
* it is a broad m. which arises from the side wall of the true pelvis & unites with its fellow of the opposite side in the median plane forming the greater part of pelvic floor.
* **Origin**: along a line from:

(1) the pelvic surface of the body of pubis.

(2) the tendinous arch (white line) of obturator fascia.

(3) inner surface of the ischial spine.

* the muscle fibres slope downwards & backwards towards the middle line.

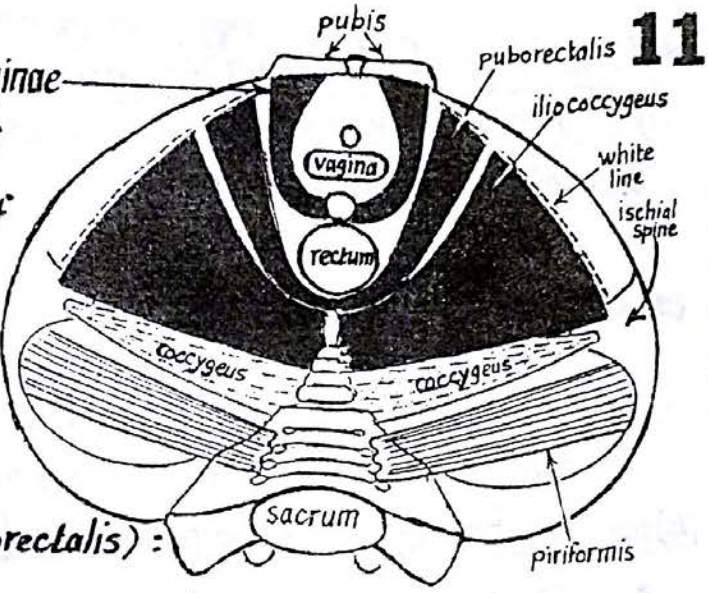


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* Insertion:

(1) the most anterior fibres (termed sphincter vaginae in the female or levator prostatae in the male):

pass backwards & medially across the sides of the vagina (in the female) or the prostate (in the male) to be inserted with their fellows of the opposite side into the perineal body in the median plane.



(2) The intermediate fibres (termed the puborectalis):

pass also backwards downwards & medially to unite with their fellows of the opposite side behind the recto-anal junction forming the puborectalis sling which is responsible for the forward convexity of the recto-anal junction.

(3) The posterior fibres (termed the ilio-coccygeus):

pass downwards, backwards & medially to be inserted into the anococcygeal lig. & the side of the coccyx.

* Nerve Supply: it has a double nerve supply:

(1) its pelvic surface is supplied by a branch from the 4th sacral n.

(2) its perineal (lower) surface is supplied by the inf. rectal n. (br. of pudendal n.).

* Action:

(1) both levator ani muscles (acting together with the abdominal diaphragm & the muscles of the ant. abd. wall) increase the intra-abdominal pressure, so help in defaecation, micturition & labour.

(2) both muscles support the pelvic viscera & keep them in position.

(3) the puborectalis part acts as an additional sphincter to the anal canal by keeping the anorectal junction closed except during defaecation.

(4) the ant. fibres of the muscle support the prostate in the male or act as a sphincter for the vagina in the female. They also steady the perineal body.

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*Relations of the levator ani

(1) its upper (pelvic) surface : is covered by the pelvic fascia & pelvic peritoneum & is related to pelvic organs ——— urinary bladder & rectum in both sexes
uterus & broad lig. in the female.

(2) its lower (perineal) surface : is covered by the anal fascia & forms the med. wall of the ischiorectal fossa.

(3) its anterior border : the ant. borders of the 2 muscles are separated by a gap which is occupied by (a) prostate & urethra in the male (b) the vagina & urethra in the female.

(4) its post. border : is free border & lies edge to edge with the coccygeus muscle.

*Applied anatomy :

- During labour, the levator ani muscles support the head of the foetus during its passage through the vagina. However, the pubococcygeus part & the perineal body may become torn leading to widening of the normal gap in the pelvic floor ⟶ prolapse of uterus (in severe cases).

Pelvic Fascia

I- Parietal pelvic fascia : includes :

(1) fascia covering obturator internus m. (obturator fascia) : see page 9

(2) fascia covering piriformis : is thin fascia covering the piriformis & the sacral plexus.

(3) fascia of the pelvic diaphragm consisting of :

(a) sup. fascia of pelvic diaphragm : covers the sup. surface of levator ani m.

(b) inf. " " " " : called anal fascia & covers the inf. surface of levator ani m.

II- Visceral pelvic fascia : includes :

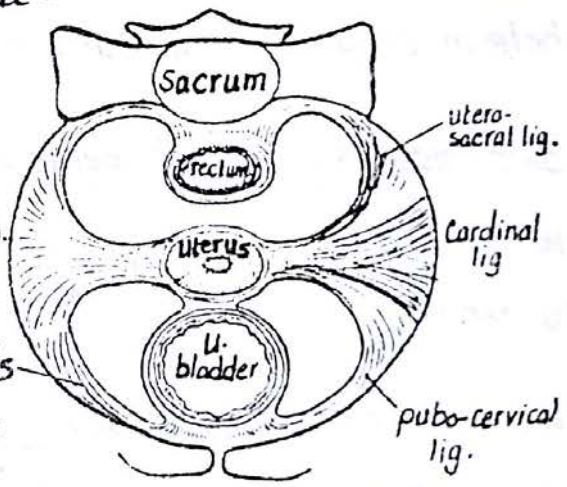
(1) the fascia which surrounds the extraperitoneal parts of the pelvic viscera. It is thin & loose around distensible organs (bladder, rectum & vagina) but dense around the nondistensible organs, like the prostate.

(2) the extra peritoneal condensations of connective tissue which connect the pelvic viscera to the pelvic wall & include :

(a) the Cardinal (Mackenrodt's) ligaments (P. 41).

(b) the uterosacral ligaments (P. 41).

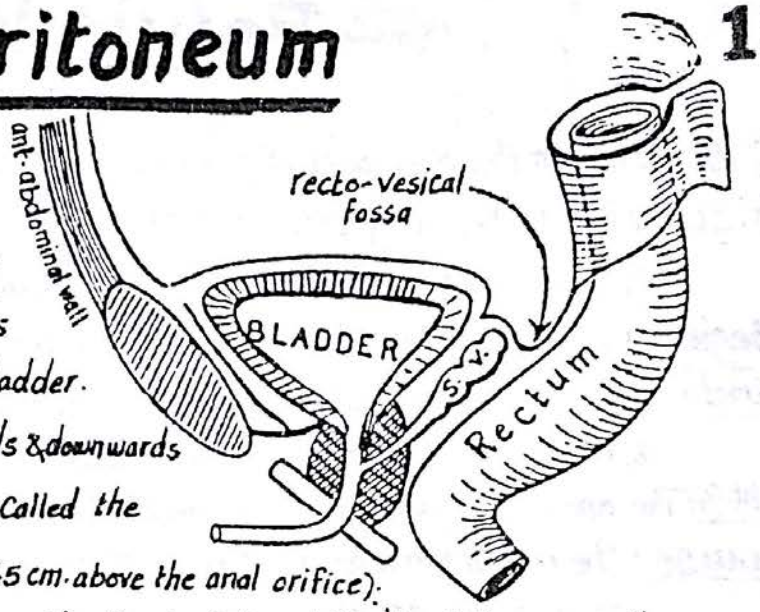
(c) the pubocervical fascia : which extends forwards from the cardinal ligaments to the back of pubis on both sides of the urinary bladder.



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Pelvic Peritoneum

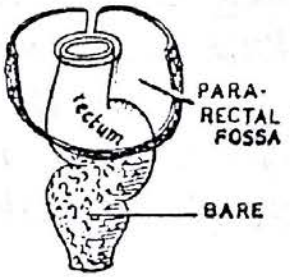
(A) In the male:



1 – the peritoneum lining the lower part of the ant. abdominal wall is reflected backwards to cover the upper surface of the urinary bladder.

2– the peritoneum is then reflected backwards & downwards above the seminal vesicle forming a recess called the recto-vesical pouch (the bottom of which lies 7.5 cm. above the anal orifice).

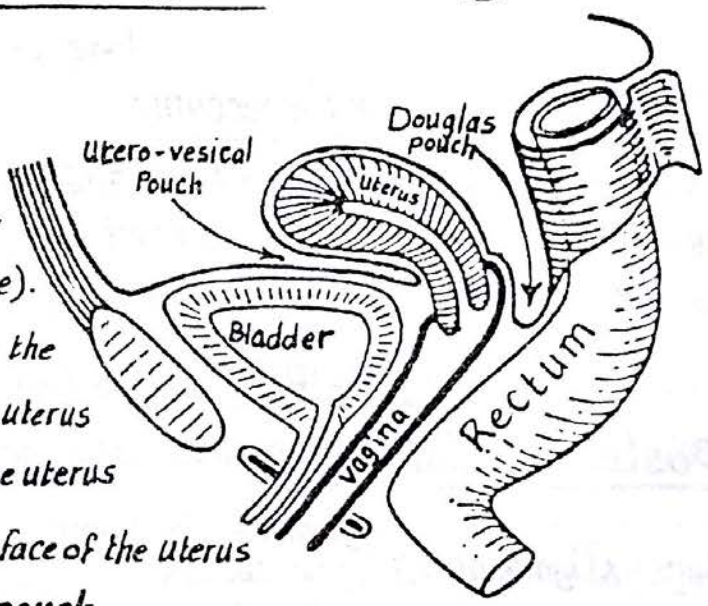
3– then the peritoneum is reflected upwards to cover the front of the middle 1/3 of the rectum then covers the front & sides of the upper 1/3 of rectum



N.B: (1) on each side of the rectum, the peritoneum lines a shallow depression called the **pararectal fossa**.

(2) similarly, on each side of the urinary bladder the peritoneum lines a shallow depression called the paravesical fossa.

(B) In the Female:



1– the peritoneum is reflected from the lower part of the ant. abd. wall to cover the upper surface of the urinary bladder (as in the male).

2– from the upper surface of the urinary bladder the peritoneum passes backwards to the front of the uterus at the junction of the body with the cervix of the uterus

3– then it is reflected forwards on the undersurface of the uterus forming a recess called the **Utero-Vesical pouch**.

4– then the peritoneum covers the following surfaces

(a) the ant. surface of the body of the uterus (b) the fundus of the uterus

(c) the post. surface of the body & cervix of uterus

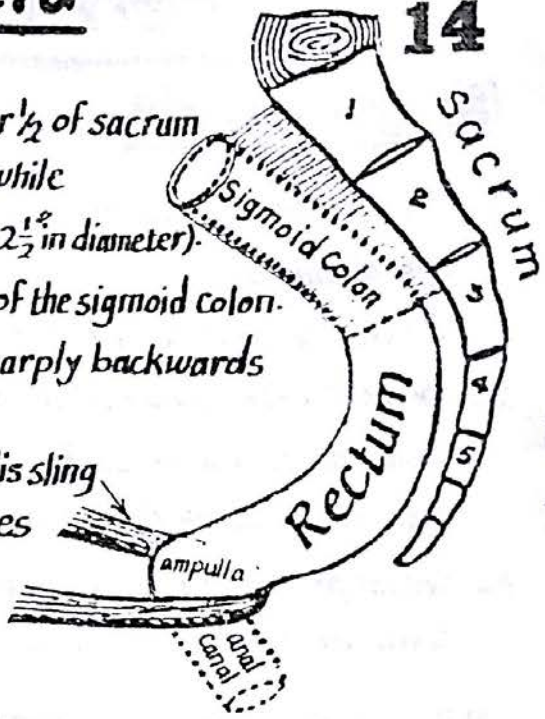
(d) the upper 1/4 of the post. surface of the vagina (post. fornix of vagina).

(5) then the peritoneum is reflected on to the front of the middle 1/3 of the rectum forming a deep recess called the **recto-uterine pouch** (of **Douglas**) the bottom of which lies 5.5 cm. above the anal orifice.

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Pelvic Viscera

1-Rectum



*Site: it lies in the post. part of pelvic cavity infront of lower ½ of sacrum

*Size: it is 5 inches long. Its upper part is 1½" in diameter while its lower part is dilated to form the rectal ampulla (2½" in diameter).

*Beginning: opposite the 3rd sacral piece as a continuation of the sigmoid colon.

*End: 1" below & infront of the tip of coccyx by bending sharply backwards & downwards to form the anal canal.

N.B: The ano-rectal junction is surrounded by the puborectalis sling

*Course: the rectum in man is not straight but shows 2 types of curvatures along its course.

*Curvatures (flexures) of the rectum:

(A) Antero posterior curves:

(1) Sacral curve (flexure): concave forwards, following the concavity of the sacrum.

(2) perineal " " : convex forwards at the recto-anal junction.

(B) Lateral curves (flexures): 3: (1) upper: convex to the Rt. side

(2) middle: convex to the Lt. side

(3) lower: convex to the Rt. side



*Peritoneal covering of the rectum:



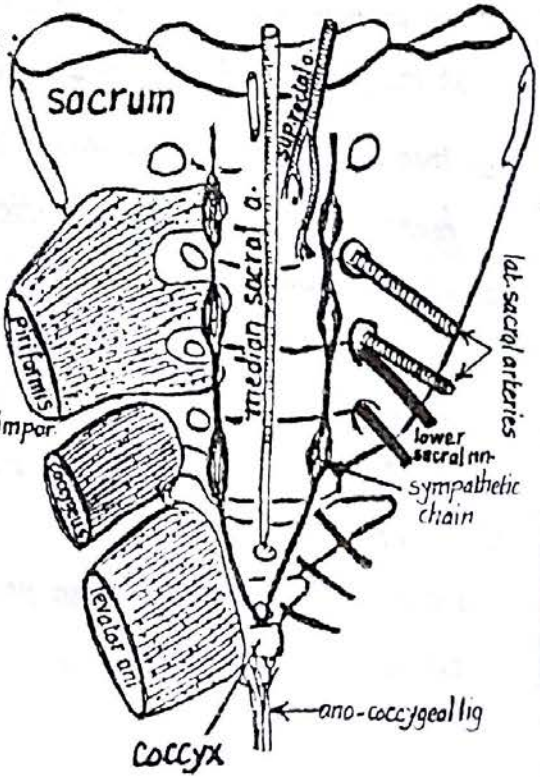
(1) its upper ⅓ is covered on the front & sides

(2) its middle ⅓: is covered on the front only

(3) its lower ⅓: has no peritoneal covering

*Relations of the rectum

(I) Posterior relations: common in the male & female:



(A) Bones & Ligaments: 3
- (1) lower ½ of sacrum.
- (2) Coccyx.
- (3) ano-coccygeal lig.

(B) Muscles (of both sides): 3
- (1) piriformis
- (2) Coccygeus
- (3) levator ani

(C) Nerves " " " : 3
- (1) 2 sympathetic chains & ganglion impar
- (2) lower 3 sacral nerves.
- (3) Coccygeal nerves

(D) Vessels: 3
- (1) superior rectal vessels.
- (2) median sacral "
- (3) lateral sacral "

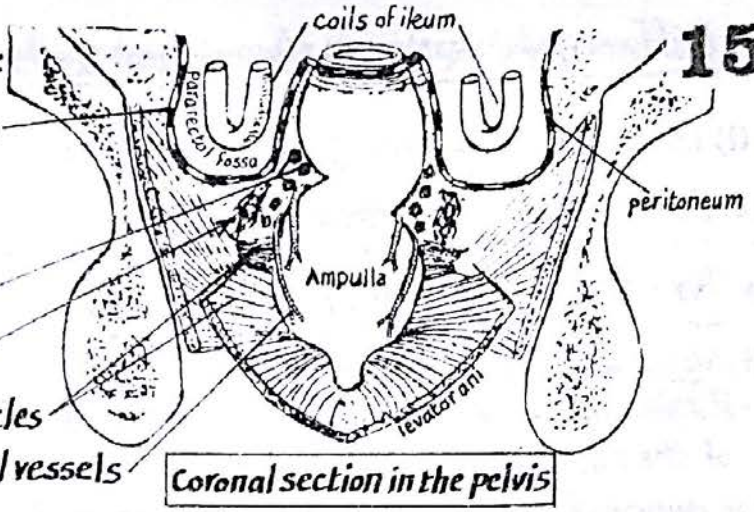
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II- Lateral relations (common in ♂ & ♀):

(1) upper 1/3: pararectal fossa of peritoneum containing coils of ileum.

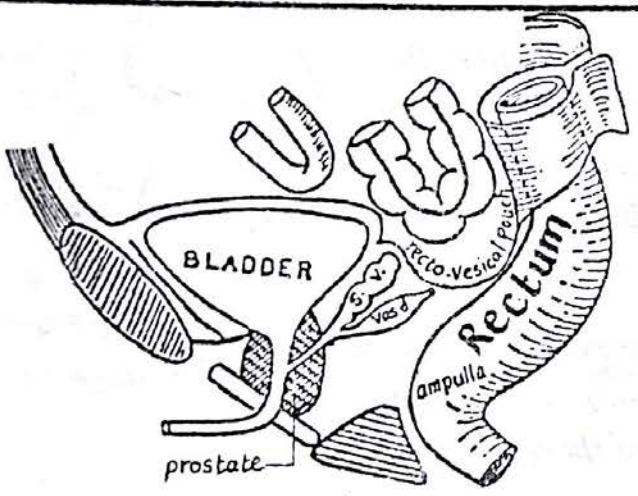
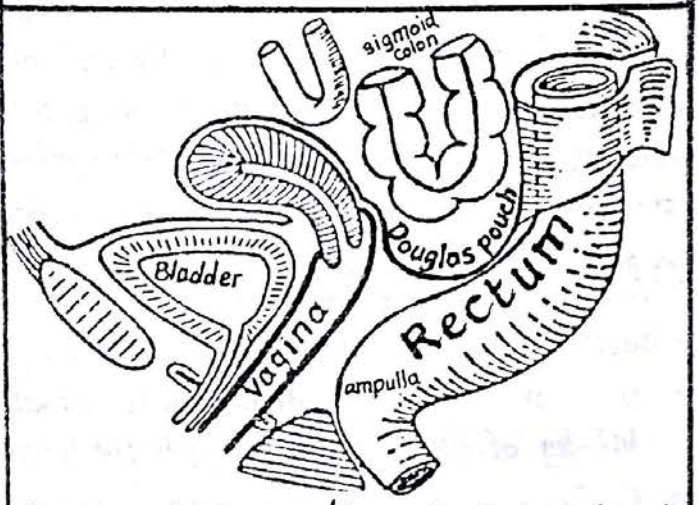
(2) lower 2/3: related to

(a) par-rectal lymph nodes
(b) inf. hypogastric plexus
(c) coccygeus & levator ani muscles
(d) branches of sup. & middle rectal vessels

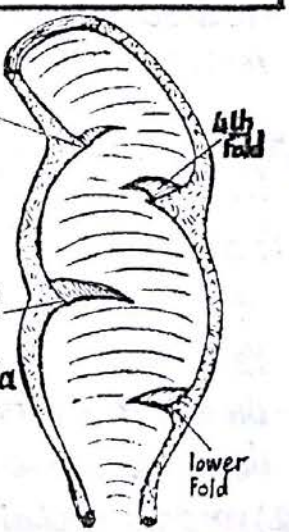


Coronal section in the pelvis

III- Anterior relations: differs in ♂ & ♀:

Anterior relations in the male	Anterior relations in the female
	
(A) upper 2/3: Covered by peritoneum & related to coils of ileum & sigmoid colon in the recto vesical pouch	(A) upper 2/3: Covered by peritoneum & related to coils of ileum & sigmoid colon in the recto-uterine (Douglas) pouch.
(B) lower 1/3: related to the base of urinary bladder, the 2 seminal vesicles, the 2 vasa deferentia & the prostate	(B) lower 1/3: related to the middle part of the post. surface of the vagina

* Mucosal folds of the rectum (Huoston's valves):



they are permanent folds formed by infolding of the mucous membrane containing extensions of the circular muscle coat. These folds include:

(1) upper fold: lies near the upper end of the rectum & projects from either the Rt. or the Lt. wall.

(2) middle fold (largest & most constant): lies at the upper end of rectal ampulla & projects from the anterior & Rt. walls.

(3) lower fold: inconstant & projects from the left rectal wall 2.5 cm below the middle fold.

(4) a 4th fold may also be present, projecting from the Lt. wall 2.5 cm above the middle fold.

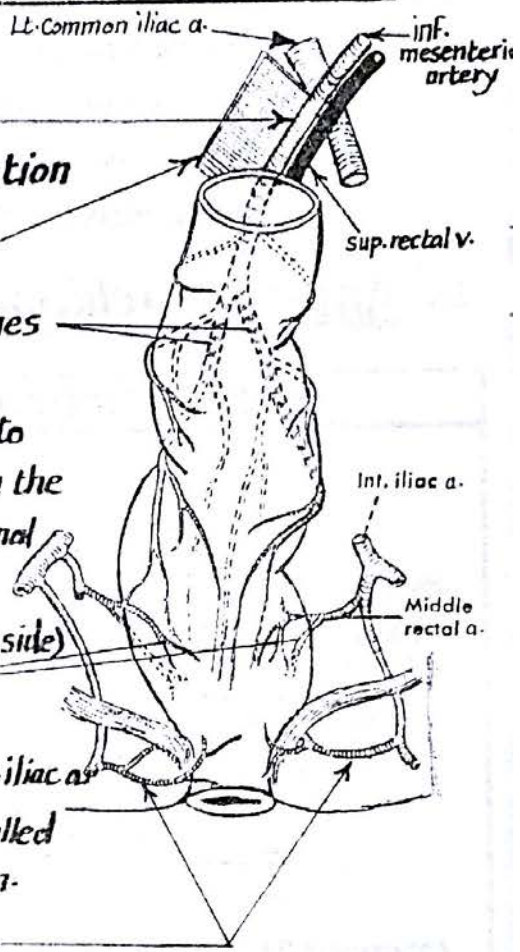
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* Differences between the rectum & other parts of large intestine:

(1) the rectum lacks the 3 characters of the large intestine — taenia coli, sacculations, appendices epiploicae.

(2) the rectum has no mesentery.

* Arterial Supply of Rectum:



(1) **Superior rectal artery**: (a single artery):
- Begins infront of Lt. common iliac artery as a direct continuation of the inferior mesenteric artery
- it descends in the medial limb of the sigmoid mesocolon
- then it runs on the back of rectum where it divides into 2 branches (Rt. & Lt.) which continue downwards on each side of the rectum
- about the middle of the rectum these Rt. & Lt. brs. break up into terminal branches which pierce the wall of the rectum & run in the submucosa as far as the anal columns in the upper ½ of anal canal where they anastomose with the middle & inferior rectal arteries.

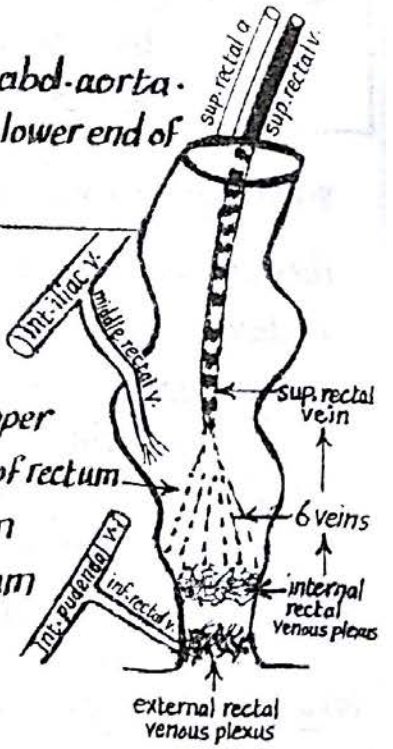
N.B: the sup. rectal a. is accompanied by the sup. rectal v. (on its Lt. side)

(2) **Middle rectal arteries**: (Rt. & Lt.):
- each artery arises from the ant. division of the corresponding int. iliac a.
- " " passes medially in a condensation of fibrous tissue called lat. lig. of the rectum to supply the lower part of the rectum.

(3) **Inferior rectal arteries** (Rt. & Lt.):
- each artery arises from the internal pudendal artery in the pudendal canal
- " " passes medially in the ischiorectal fossa to reach the anal canal & anastomoses with the sup. & middle rectal arteries

(4) **Median sacral artery**:
- it is a single artery which arises from the back of the lower end of the abd. aorta.
- it descends infront of the middle line of sacrum to reach the back of lower end of rectum where it supplies the post. wall of the recto-anal junction.

* Venous drainage of the Rectum:



(1) **Superior rectal vein**: (portal):
- it arises from the internal rectal venous plexus in the submucosa of upper ½ of the anal canal which gives rise to 6 tributaries in the submucosa of rectum
- these 6 tributaries pierce the muscle layer of the rectum & unite to form the single sup. rectal v. at the junction of lower 2/3 & upper ⅓ of the rectum

(2) **middle rectal v.**: (Systemic): Rt. & Lt.:
- begin in the submucosa of the lower ⅓ of the rectum.

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- Each vein runs laterally in company with middle rectal a. to end in the internal iliac vein.

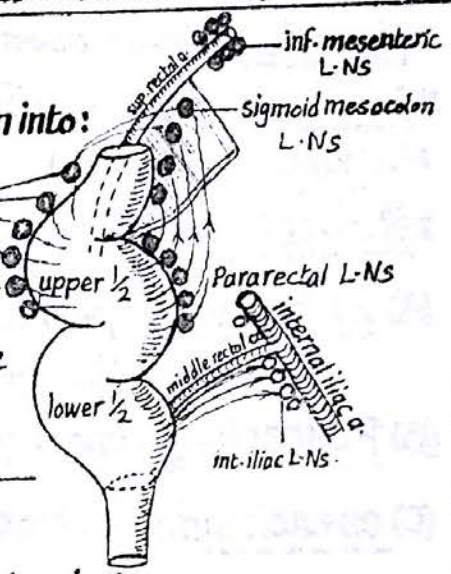
(3) **Inferior rectal V. (Rt. & Lt.): (Systemic):**

- arise from the external rectal venous plexus (in the submucosa of lower ½ of anal canal).
- each v. runs laterally in the ischiorectal fossa (in company with inf. rectal a.) to end in int. pudendal v.

* Lymphatic drainage of the Rectum:

(1) Lymphatics of the upper ½ of rectum follow sup. rectal a. to drain into:
- (a) pararectal L-Ns on each side of the rectum
- (b) L-Ns in the sigmoid mesocolon along sup. rectal vessels
- (c) inf. mesenteric L-Ns around the origin of inf. mesenteric a.

(2) Lymphatics of the lower ½ of the rectum: pass along the middle rectal vessels to drain into internal iliac L-Ns.



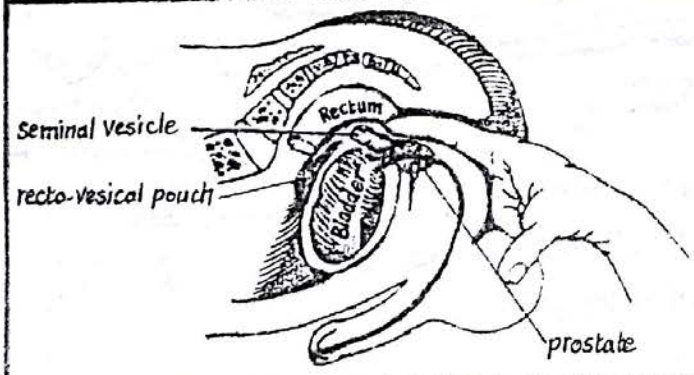
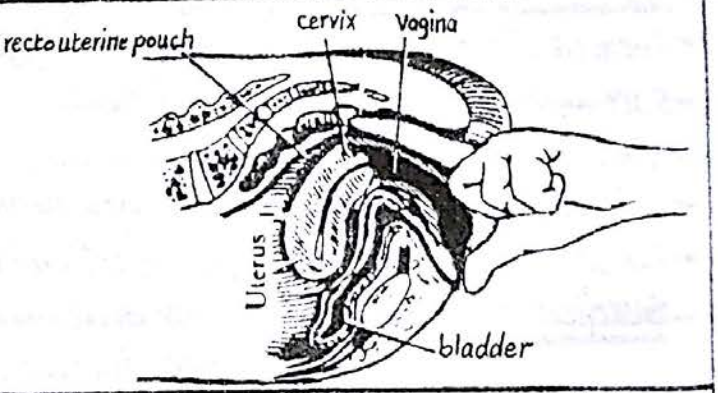
* Nerve supply of the Rectum:

(1) parasympathetic fibres: derived from S 2,3,4 via pelvic splanchnic n.
(2) sympathetic fibres: from L1,2 through the inf. mesenteric plexus.

N.B: sensations from the rectum are carried by both sympathetic & parasymp. fibres

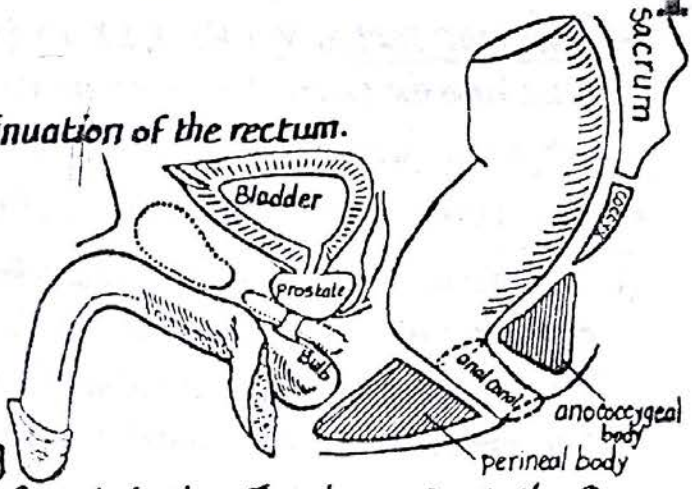
* Applied anatomy: P-R examination:

P-R (per rectum) examination is done by inserting the index finger into the lower part of the rectum through the anal orifice to palpate the surrounding structures which differ according to the sex as follows

Structures felt in the male	Structures felt in the female
	
(1) the tone of the external anal sphincter, any mass inside the lumen or lesion in the wall of rectum (2) Laterally: ischiorectal fossa, ischial tuberosity & ischial spine (in both sexes). (3) posteriorly: the coccyx & lower ½ of the pelvic surface of sacrum " " .	
(4) Anteriorly: (a) bulb of the penis (b) prostate (c) seminal vesicles (if enlarged) (d) base of bladder (e) fluid in recto-vesical pouch	(4) Anteriorly: (a) the vagina (b) cervix of uterus. (c) cysts & tumours in the broad lig. " " . (d) fluid collection in the recto-uterine pouch

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ANAL CANAL

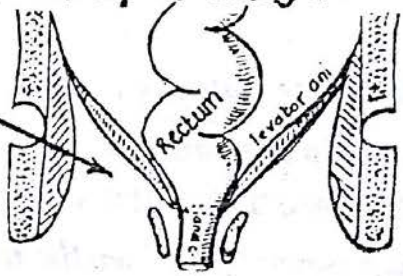


* **Begins**: 1" below & infront of coccyx as a continuation of the rectum.
* **Direction**: passes downwards & backwards.
* **Ends**: at the anal orifice.
* **Length**: $1\frac{1}{2}$" (4 cm).
* **Relations**:

(A) **Anteriorly**: perineal **Body** separating the anal canal from the bulb of penis in the ♂ & the vagina in the ♀

(B) **Posteriorly**: anococcygeal **Body** separating the canal from tip of coccyx

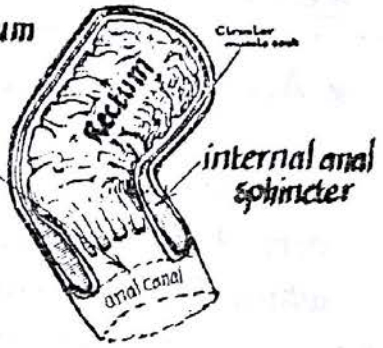
(C) **on each side**: ischiorectal **Fossa** containing fat.



* **Sphincters of the anal canal**:

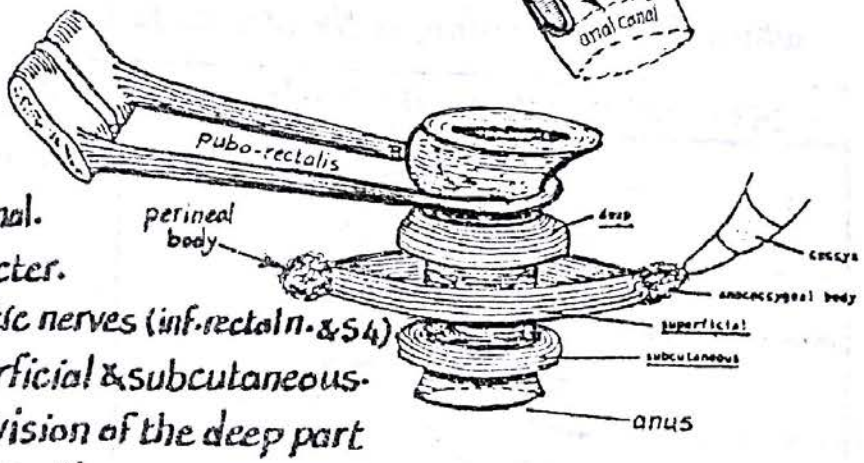
(A) **Internal anal sphincter**:

- it is the continuation of the circular muscle layer of the rectum
- it surrounds the upper 3/4 of the anal canal.
- it begins at the anorectal junction & ends at the White line
- it is an involuntary sphincter & supplied by autonomic nerves.



(B) **External anal sphincter**:

- formed of striated muscle fibres.
- surrounds the whole length of anal canal.
- lies outside the internal anal sphincter.
- it is voluntary & supplied by somatic nerves (inf. rectal n. & S4)
- Consists of 3 parts: deep, superficial & subcutaneous.
- Surgical importance: complete division of the deep part produces incontinence.

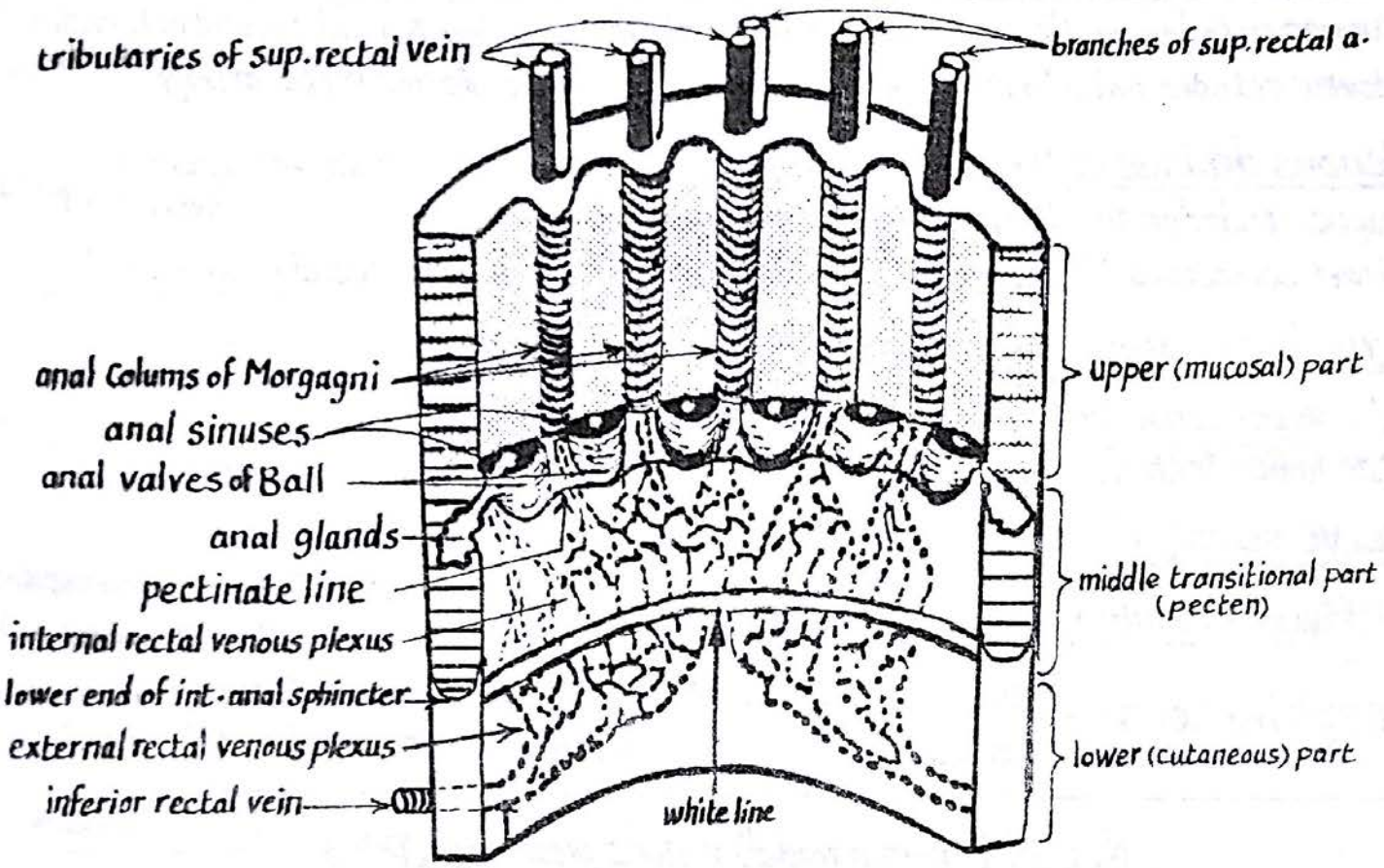


(C) **Ano-rectal ring**:

- It is a muscular ring at the junction of the rectum & anal canal.
- It is formed by the fusion of 4 muscular structures: (1) pubo-rectalis part of levator ani (2) deep part of ext. anal sphincter (3) the longitudinal muscle layer (4) the internal anal sphincter.
- On P.R exam the ring is felt as a ridge (more marked posteriorly & laterally).

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Cavity & mucous membrane of the anal Canal



* The lining of the anal canal is divided into 3 parts :

(1) **Upper part** (1-5 cm) : mucous part :

- lined by columnar epithelial mucous membrane (endodermal in origin, from the cloaca).
- it shows 6-10 vertical folds called **Anal Columns of Morgagni** (covering the terminal brs. of sup. rectal a. & the accompanying veins).
- the lower ends of the anal columns are connected by crescentic folds called **anal Valves of Ball.**
- above each anal valve there is a small recess called **anal sinus** receiving the opening of anal gland.
- the circular line of attachment of the anal valves is called the **pectinate line**. It lies opposite the middle of the internal anal sphincter (the junction of the endodermal & ectodermal parts)

(2) **Middle part** (1-5 cm) : transitional zone or pecten :

- it is lined by non-keratinized stratified squamous epithelium devoid of sweat glands (false skin)
- it extends from the pectinate line above to the white line of Hilton below.
- the white line of Hilton demarcates the lower end of the internal anal sphincter.

(3) **Lower part** (1 cm) : cutaneous part :

- it lies between the white line above & the anal orifice below.
- it is lined by true skin containing sweat & sebaceous glands.

N.B : the middle & lower parts are ectodermal in origin (from the proctodeum).

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* Arterial Supply of the anal canal :

(1) upper endodermal 1½ cm (above the pectinate line) : by sup. & middle rectal arteries.
(2) lower ectodermal 2½ cm (below » » ») : by inferior rectal artery.

* Venous drainage of the anal canal :

(1) upper endodermal 1½ cm (above the pectinate line): by sup. rectal vein (portal) / middle » » (systemic).
(2) lower ectodermal 2½ cm (below the pectinate line) : by inferior rectal V. (systemic).

* Lymphatic drainage :

(1) the upper (endodermal) part : drains into the internal iliac L. Ns.
(2) the lower (ectodermal) part : drains into the superficial inguinal L. Ns.

* Nerve supply of the anal canal :

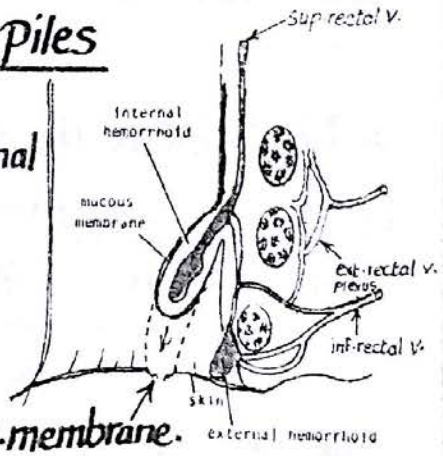
(A) Mucous membrane : (1) upper endodermal part : by autonomic n. fibres (insensitive to pain).
(2) lower ectodermal part : by somatic n. (inf. rectal) : sensitive » »).

(B) Sphincters : (1) internal anal sphincter : by autonomic nerves (see page 18).
(2) external » » : by somatic nerves (inf. rectal n. & S_4).

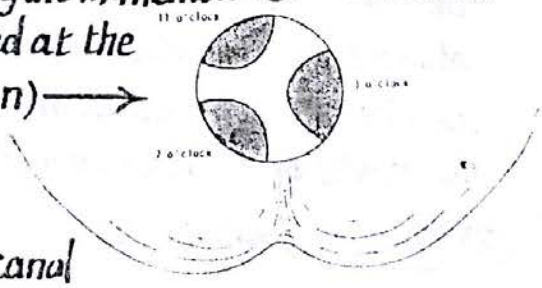
Rectal (haemorroidal) venous plexuses & Piles

(1) Internal rectal venous plexus :

- it lies in the submucosa of the lower part of the rectum & anal canal
- it is formed by the tributaries of the sup. rectal V. (portal) which lie in the anal columns of Morgagni.
- it communicates with the external rectal venous plexus which is formed by the middle & inf. rectal veins (systemic)



* **Internal piles** : is dilatation of inf. rectal V. plexus pushing the m. membrane. It occurs mainly in the veins of the 3 anal columns situated at the 3, 7, 11 o'clock positions (as seen in the lithotomy position) →



(2) External rectal venous plexus :

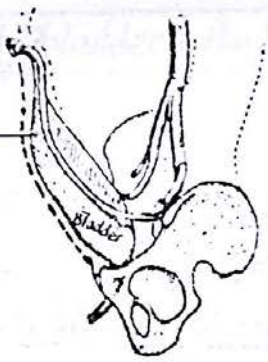
- it lies outside the muscular coat of the rectum & anal canal
- it is formed by the tributaries of middle & inf. rectal veins (systemic).
- it communicates freely with the internal rectal plexus (porto-systemic anastomosis).

* **External piles** : is the rupture of a dilated vein from the external rectal plexus into the peri-anal space. It occurs below the pectinate line (therefore very painful).

* Other clinically important points about anal canal :

(1) **Anal fissure** : is the rupture of one of the anal valves (usually by the passage of hard dry stools).
(2) **peri-anal abcess** : is an infection around the anal canal. It may be (1) submucous (2) subcutaneous or (3) may occupy the ischiorectal fossa.

URINARY BLADDER



***Site:**

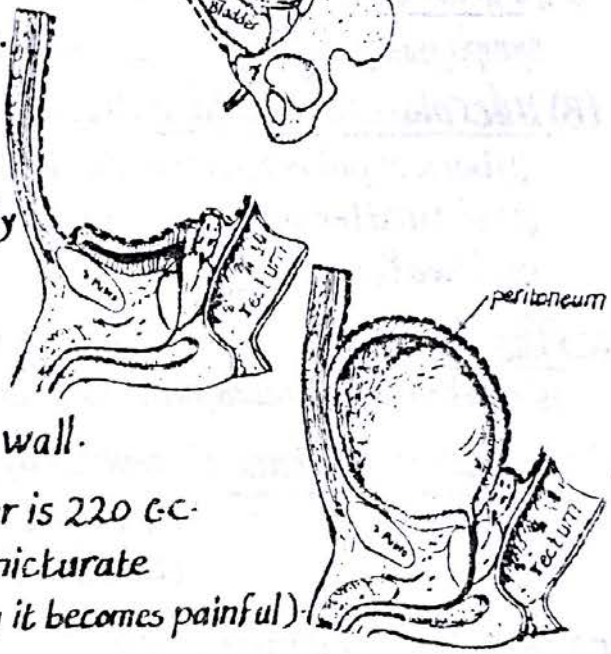
(1) **At birth**: it lies completely in the abdominal cavity (due to the small size of the pelvis).

(2) **In children**: it becomes a pelvi-abdominal organ.

(3) **In the adult**:

(a) an empty bladder is pelvic organ, occupying the most ant. compartment of the lesser pelvis, directly behind the symphysis pubis.

(b) when the bladder distends, it ascends into the abdomen & pushes up the parietal peritoneum lining the lower part of the anterior abdominal wall.



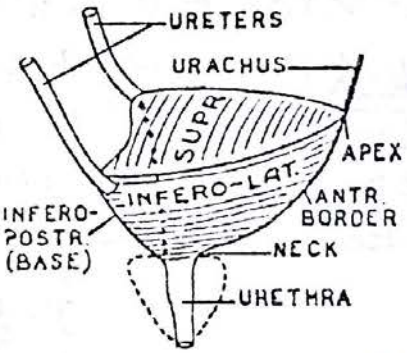
***Size**: the average capacity of the adult bladder is 220 cc.
A volume beyond 220 cc causes desire to micturate
(it can accomodate up to 500 cc, beyond which it becomes painful).

*Shape, surfaces & borders:

I- Empty bladder: is 4-sided pyramid (resembling a cut ant. part of a ship), having:

(a) **4 surfaces**:
- superior surface
- posterior surface (base)
- Lt. & Rt. inferolateral surfaces

(b) **4 angles**:
- ant. angle (called apex) ... infront
- inf. angle (called neck) ... below
- 2 postero-superior angles .. behind



(c) **4 ducts** are related to the angles of the bladder:
- the 2 ureters open into the 2 postero superior angles
- the urethra comes out from the neck (inf. angle)
- the urachus (obliterated after birth to form the **median umbilical lig.**) is attached to the ant. angle (apex).

II- Full bladder: is ovoid in shape having:

(a) **4 surfaces**:
- antero-inferior surface
- posterosuperior surface
- 2 lateral surfaces

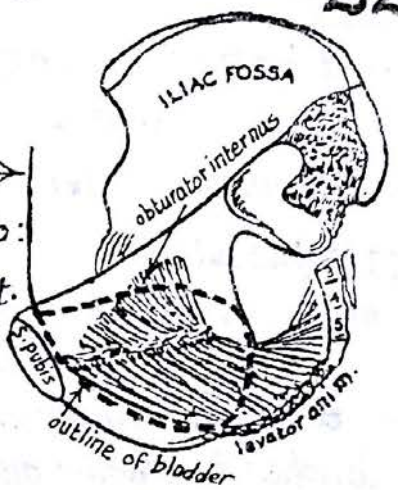
(b) **2 angles**:
- apex (summit): directed upwards
- neck: directed downwards



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Relations of the urinary bladder

I- In the Male

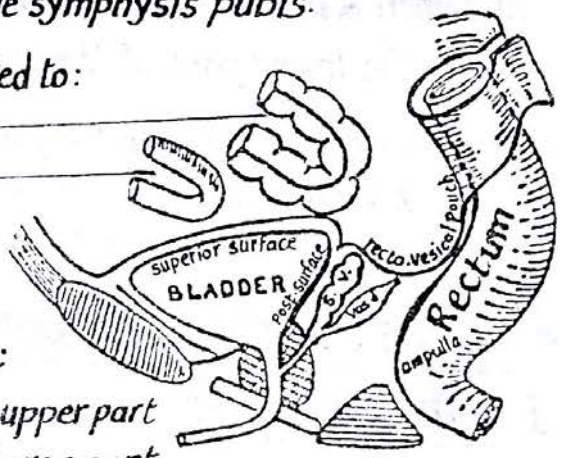


(A) **Apex (ant.-angle)**: lies behind the upper border of the symphysis pubis & gives attachment to the median umbilical lig.

(B) **Inferolateral surface**: has no peritoneal covering & is related to:
(1) back of pubis & retropubic space (Cave of Ritzius) containing fat.
(2) obturator internus muscle.
(3) levator ani muscle.

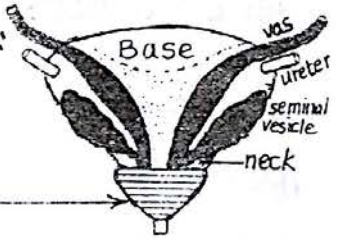
(C) **The Ant.-border** (the meeting of the 2 inferolateral surfaces): is related to the retropubic fat, separating it from the symphysis pubis.

(D) **Superior surface**: is covered by peritoneum & related to:
(1) pelvic (sigmoid) colon
(2) coils of ileum



(E) **Posterior surface (Base)**:
- its upper ½ an inch is covered by peritoneum.
- it is related to the rectum but separated from it by:
(1) the rectovesical pouch containing coils of ileum ... in the upper part
(2) the vasa deferentia & seminal vesicles in the lower part

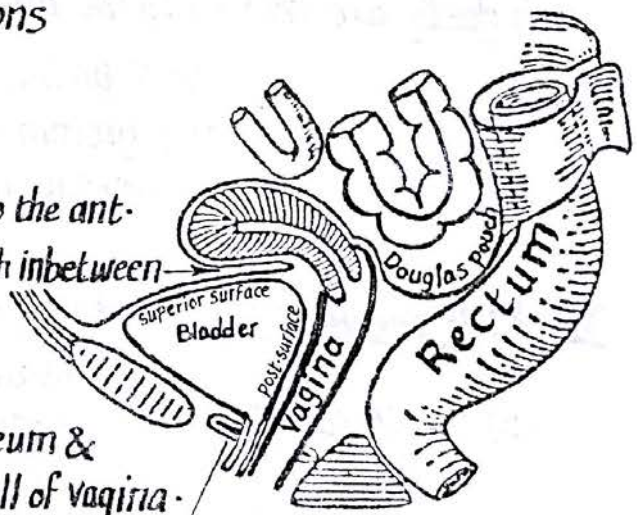
(F) **Neck (inf.-angle)**: the lowest & most fixed part of the bladder:
- it lies 1½ inch behind the lower border of the symphysis pubis
- it is pierced by the internal urethral meatus
- it rests on the base of the prostate gland



II- Relations in the Female

(A) Apex (ant.-angle)
(B) Inferolateral surface
(C) Anterior border
} have the same relations as in the male

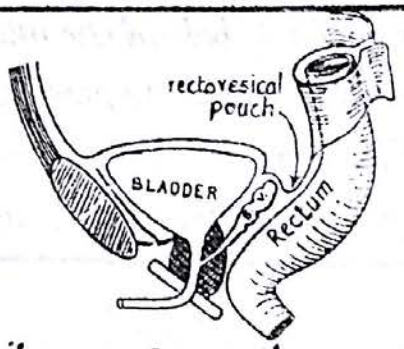
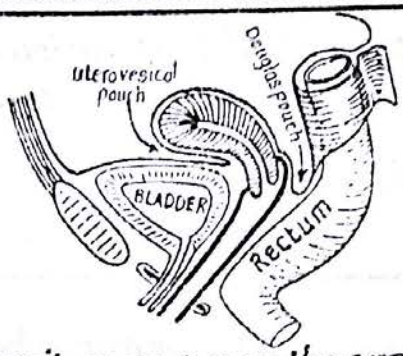
(D) **Superior surface**:
(1) its greater part is covered by peritoneum & related to the ant. (vesical) surface of uterus with the rectovesical pouch inbetween
(2) its most posterior part is devoid of peritoneum & is related to the supravaginal part of the cervix



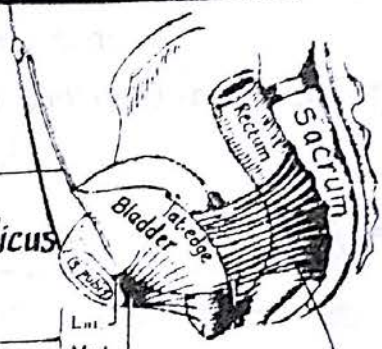
(E) **Posterior surface** (base): is devoid of peritoneum & related to upper part of ant. wall of vagina.

(F) **Neck (inf.-angle)**:- rest on the pelvic fascia
- gives attachment to the pubo-vesical ligament.

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*Peritoneum of the bladder in the male	*Peritoneum of the bladder in the female
	
The peritoneum covers the sup.surface & the upper part of the post.surface (base) then reflected into the rectum forming the recto-vesical fossa.	The peritoneum covers the sup.surface only then reflected into the ant.surface of the uterus forming the utero-vesical pouch.

* Ligaments of the bladder



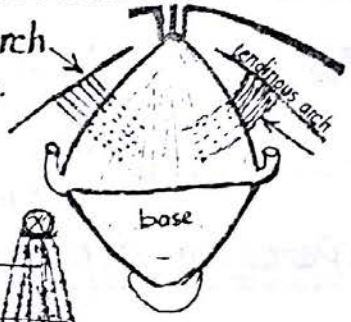
(A) True ligaments:

(1) **Median umbilical lig.** (obliterated urachus): extends from the apex of the bladder to the inner aspect of umbilicus.

(2) **Puboprostatic** (pubo-vesical in ♀) **ligaments:**
- they are 2 ligaments on each side (med. & lat.)
- they extend from the back of pubis to the prostatic fascia (in ♂) or neck of bladder (in ♀).

(3) **Posterior lig.**: extends from the lat.edge of base of bladder to the front of the sacrum.

(4) **Lateral lig.**: extends from the side of the bladder to the tendinous arch of the fascia covering the obturator internus muscle.



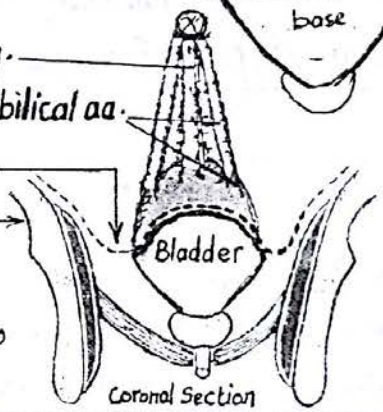
(B) False ligaments: they are peritoneal folds which include:

(1) **median umbilical fold**: covering the median umbilical lig.

(2) **medial umbilical folds** (Rt. & Lt.): covering obliterated umbilical aa.

(3) **Lateral false ligament**: is the reflection of peritoneum from the side of the bladder to the side of the pelvis.

(4) **posterior false ligament** (sacrogenital fold): is a peritoneal fold extending from the side of the bladder to the front of the sacrum.

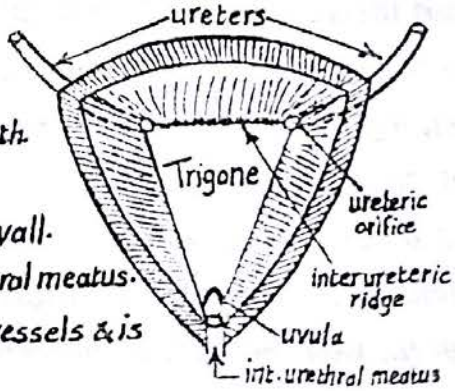


Interior of the bladder:

the mucosa shows folds (rugae) except the trigone which is smooth.

* The trigone

- it is a triangular area on the inner aspect of the post.bladder wall.
- it is bounded by 3 lines connecting the 2 ureteric orifices & int.urethral meatus.
- it shows: (1) smooth mucosa which is richly supplied by nerves & vessels & is firmly adherent to the underlying muscle coat.



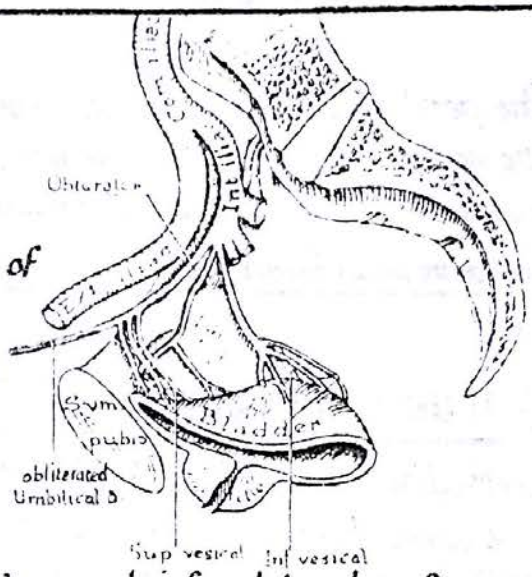
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(2) inter-ureteric ridge : a transverse ridge between the 2 ureteric orifices.

(3) Uvula vesica : a slight elevation on the trigone immediately behind the internal urethral meatus. It is produced by the median lobe of the prostate gland.

(4) Internal urethral meatus : is situated at the apex of the trigone in the most dependent part of the bladder & is surrounded by the **Sphincter Vesicae**.

* Arterial supply of the urinary bladder :



(1) Sup. vesical a. : from the proximal patent part of the obliterated umbilical a.

(2) inf. vesical a. (vaginal a. in the ♀) : from ant. division of internal iliac a.

(3) additional branches arise from obturator, inf. gluteal & in the female from the uterine a.

* Venous drainage :

the vesical veins form a plexus (vesical venous plexus) on each inferolateral surface then drain into the internal iliac veins

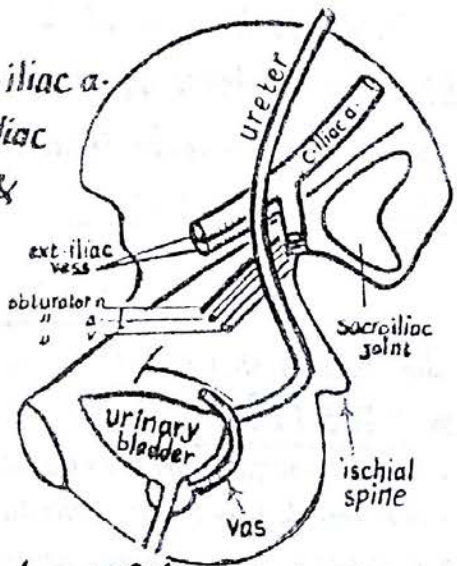
* Lymphatic drainage : into the external iliac L. Ns.

* Nerve supply of the bladder :

(1) Sympathetic: - from T11, 12 & L1, 2 segments of the spinal cord.
- it is inhibitory to the muscular wall & motor to the sphincter vesicae.

(2) Parasympathetic: - from pelvic splanchnic n. (S 2, 3, 4)
- it is motor to the muscular wall & inhibitory to the sphincter vesicae.

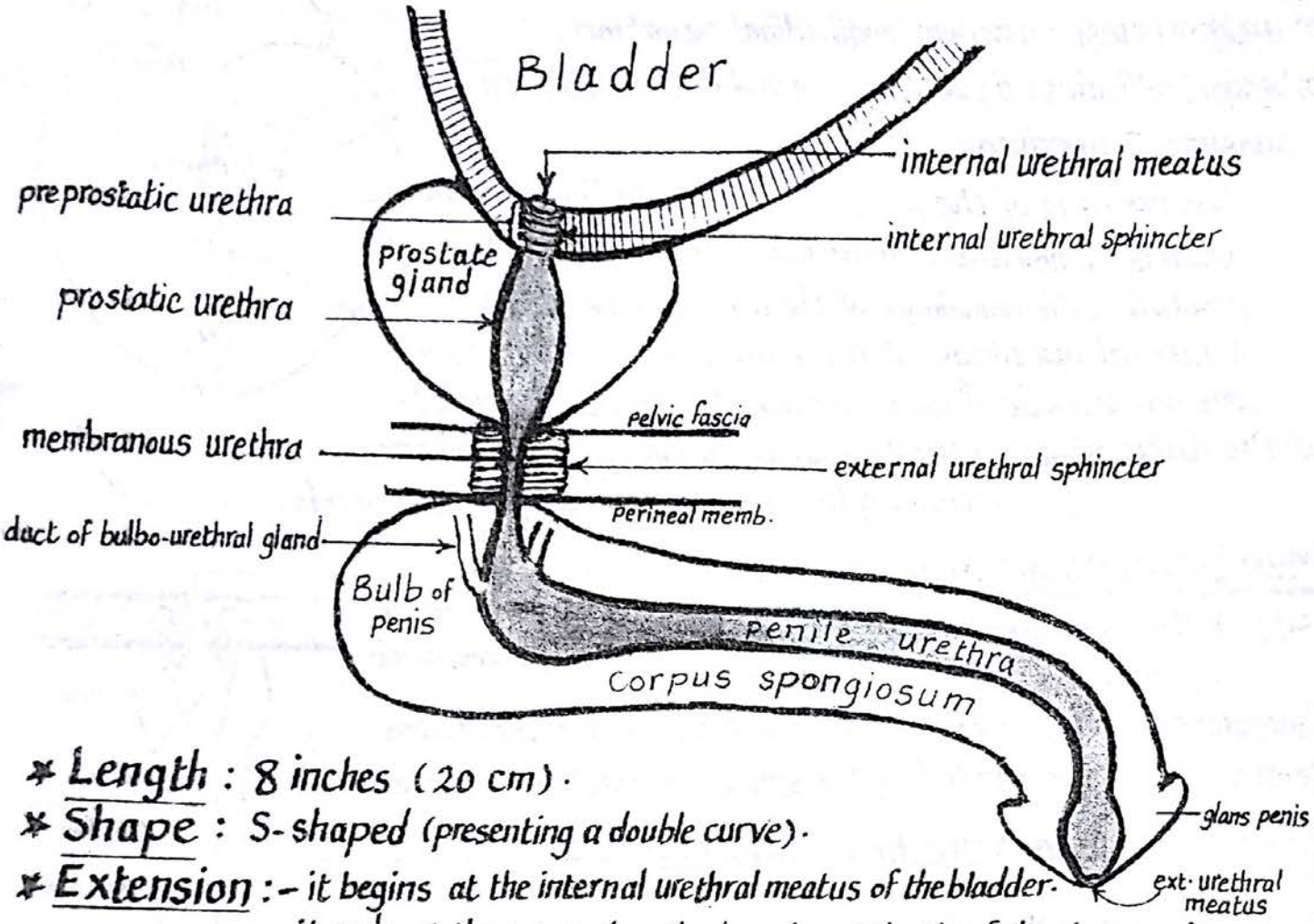
Pelvic part of the ureter



- it enters the pelvis by crossing infront of the bifurcation of C. iliac a.
- it runs downwards & backwards along the lower border of int. iliac artery, crossing the ext. iliac vessels, obturator n. & vessels & covered medially by peritoneum.
- opposite the ischial spine, the ureter curves anteromedially to open into the postero-superior angle of the urinary bladder. Here it passes on the side of the vagina in the female & is crossed by the vas deferens in the male.
- after joining the bladder, the ureter runs a very oblique course through its wall for 2 cm before opening into its cavity (intra-mural part of the ureter).

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MALE URETHRA



* **Length** : 8 inches (20 cm).
* **Shape** : S-shaped (presenting a double curve).
* **Extension** :- it begins at the internal urethral meatus of the bladder.
 - it ends at the external urethral meatus at the tip of the glans penis.

* **Parts** : it has 4 parts : preprostatic, prostatic, membranous & Penile.

(I) Preprostatic part : (½ inch) :

* **Site** : it extends vertically from the int. urethral meatus to sup. aspect of prostate
* **Characters** : it has a stellate lumen
* **relations** : it is surrounded, together with the bladder neck, by the internal urethral sphincter (sphincter vesicae) formed of circular muscle fibres supplied by sympathetic fibres. This sphincter contracts at ejaculation preventing the retrograde flow of the semen into the bladder.

(II) Prostatic part : (1½ inches) :

* **site** : - it traverses the prostate gland from base to apex, lying closer to the anterior than the posterior surface of the gland.
 - it emerges from the prostate slightly anterior to its apex.
* **Characters** :

(1) it is the widest & most dilatable part of the whole urethra.

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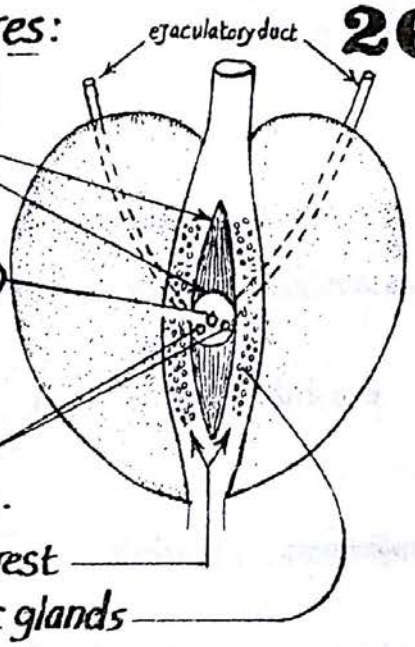
(2) the posterior wall of its lumen shows the following features:

(a) urethral crest : a median longitudinal elevation

(b) Seminal colliculus : a swelling in the middle of urethral crest showing 3 openings :

- the opening of the prostatic utricle (in the middle) which is a small diverticulum in the median lobe of the prostate (the homologue of the uterus in the female) .
- 2 lateral openings of the ejaculatory ducts : (one on each side of the opening of the prostatic utricle) .

(c) Prostatic sinus : a shallow groove around the urethral crest receiving the openings of the prostatic glands



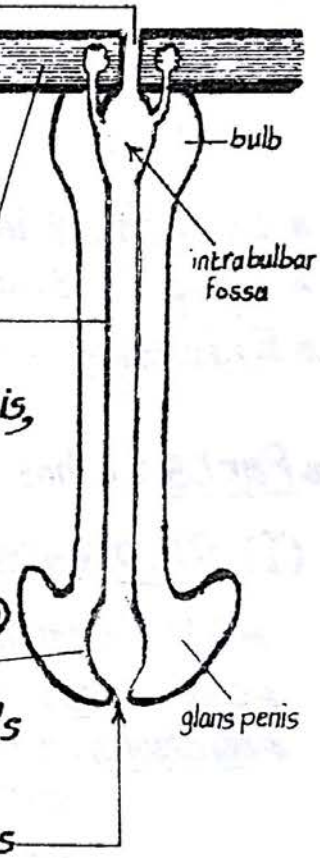
I) Membranous urethra: (½ inch):

* Site : it descends downwards piercing 2 membranes { pelvic fascia, perineal memb. } i-e it traverses the deep perineal pouch.
* Characters : it is the narrowest & least dilatable part of the urethra
* Relations : it is surrounded by the sphincter urethrae muscle

V) Penile (Spongy) urethra : (6 inches) :

* Site : it begins at the end of membranous urethra, traverses bulb of penis, the whole length of the corpus spongiosus & the glans penis to end at the external urethral meatus
* Characters: (1) it is narrow transverse slit (when empty) .
 (2) it has a dilatation at its beginning (intrabulbar fossa)
 (3) » » » » » » end (navicular fossa)
 (4) it receives the openings of the bulbo-urethral glands one inch below the perineal membrane .

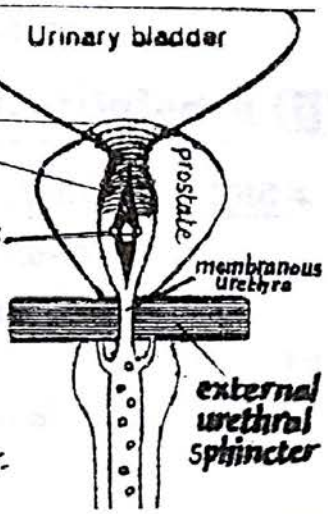
N.B : the narrowest point of the urethra is the external urethral meatus



URETHRAL SPHINCTERS

1) Internal urethral sphincter (sphincter vesicae):

* Site : it surrounds the bladder neck, preprostatic urethra & prostatic urethra above the openings of the ejaculatory ducts
* Nature : circular collar of smooth muscle fibres with admixure of elastic & collagenous fibres .
* N. Supply : by Sympathetic fibres.
* Function : it prevents the retrograde flow of ejaculate into the bladder.

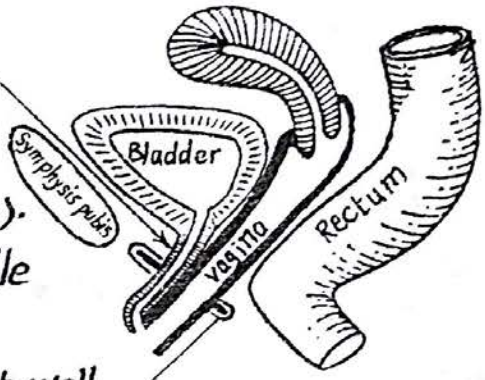


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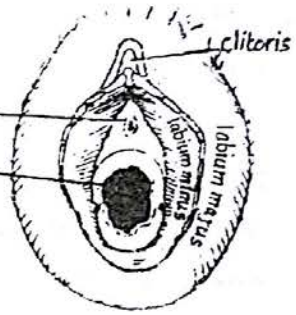
(2) External urethral Sphincter (Sphincter urethrae):

* Site: it surrounds the membranous urethra in the deep perineal pouch.
* Nature: it is formed of striated muscle fibres consisting of superficial & deep parts (see deep perineal pouch page 52).
* N. supply: perineal branch of pudendal n. (S2,3,4)
* Function: - it is responsible for voluntary holding of urine.
 - it relaxes during micturition but contracts to expel the last drops of urine or semen.

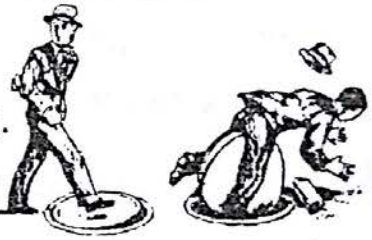
FEMALE URETHRA



* Length: 4 cm (corresponds to the part of male urethra lying above the prostatic utricle).
* Diameter: 6 mm (wider & more dilatable than male urethra).
* Begins: at the internal urethral meatus 2" behind the middle of the symphysis pubis.
* Course: it runs downwards & forwards, embedded in the ant. wall of the vagina, traversing the deep perineal pouch.
* Ends: at the external urethral meatus which is a sagittal slit with 2 lips lying in the vaginal vestibule directly infront of the vaginal orifice & one inch behind the clitoris.
* Sphincter: the female urethra is surrounded by an internal urethral sphincter (sphincter urethrae) which is weaker than that of the male

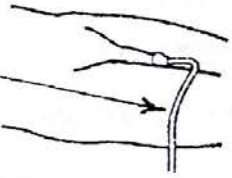


* Applied anatomy about male urethra:



(1) Rupture of urethra: may result from fall astride sharp object. The most commonly affected parts are the membranous & spongy urethra.

(2) Catheterization of the bladder:



It is the introduction of a catheter (rubber or metalic tube) through the urethra to reach the urinary bladder. The following points should be considered:

(a) the external urethral meatus is the narrowest point; once a catheter passes through this orifice it will continue up to the bladder.

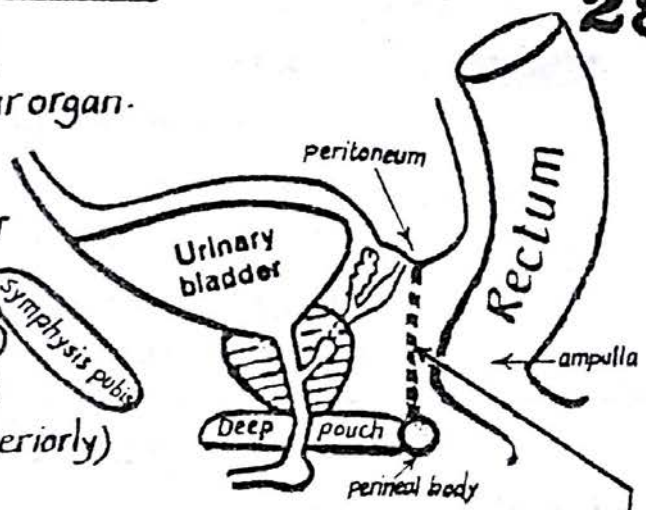
(b) While passing a metallic catheter one should remember the normal curvatures of the urethra.

N.B: female urethra is shorter, wider & easily dilatable thus catheters can be easily passed.

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MALE GENITAL ORGANS

1- Prostate



* **Structure**: it is a firm fibro-musculo-glandular organ.
* **Site**: below neck of the bladder (surrounding the prostatic urethra), 2 cm behind the lower border of the symphysis pubis.
* **Shape**: inverted cone.
* **Size**: its average dimentions — 4 cm (tranversely), 3 cm (vertically), 2 cm (anteroposteriorly)
* **Weight**: 8 gm.

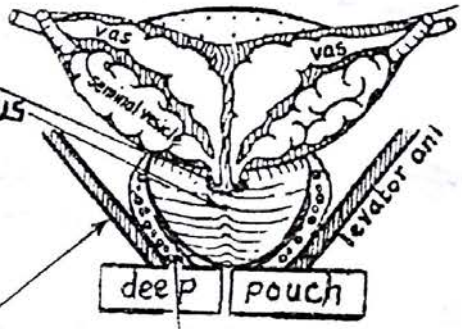
* **Surfaces & Relations**:

I- Base: (directed upwards): it is directly continuous with the bladder neck; it is pierced by the urethra nearer to its ant-aspect

II- Apex: (directed downwards): lies in direct contact with the fascia on the superior aspect of the deep perineal pouch.

III- Post-surface:

- lies infront of ampulla of rectum (separated from it by the fascia of Denovilliers)
- near its upper border there is a depression through which the 2 ejaculatory ducts pierce the prostate
- below the entery of ejaculatory ducts, a shallow median sulcus separates the Rt- & Lt- prostatic lobes.

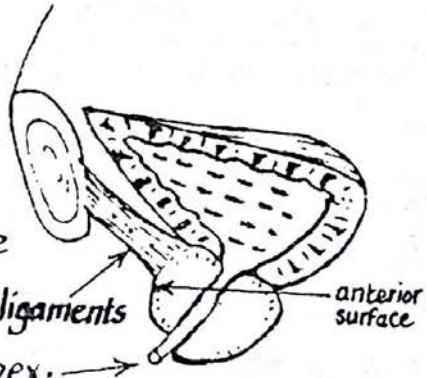


IV- 2 Inferolateral surfaces:

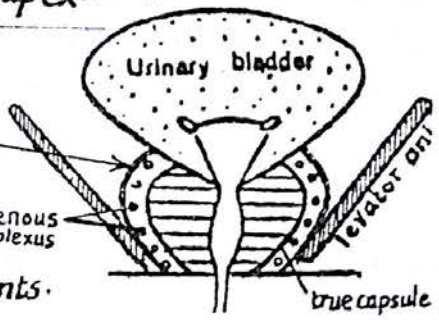
are clasped by the ant-fibres of levator ani muscle & separated from it by the prostatic venous plexus.

V- Anterior Surface:

- is a narrow convex surface, extending from base to apex.
- it lies 2 cm behind the symphysis pubis from which it separated by fat & plexus of veins in the retropubic space
- its upper part is connected to pubic bones by puboprostatic ligaments
- the urethra emerges from this surface a little above its apex.



Capsules of the prostate



(1) **Outer false capsule** (prostatic sheath):

- it is formed by condensation of pelvic fascia.
- it is avascular posteriorly.
- it is connected to the back of pubis by the puboprostatic ligaments.

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(2) **Inner true capsule**:
is a fibromuscular sheath forming the outer surface of the gland.

N.B: (a) the true capsule is separated from the false capsule by the prostatic venous plexus.
(b) pathologically, a third capsule is formed of compressed normal prostatic tissue (deep to the true capsule in case of senile prostatic enlargement.

* Lobes of the prostate

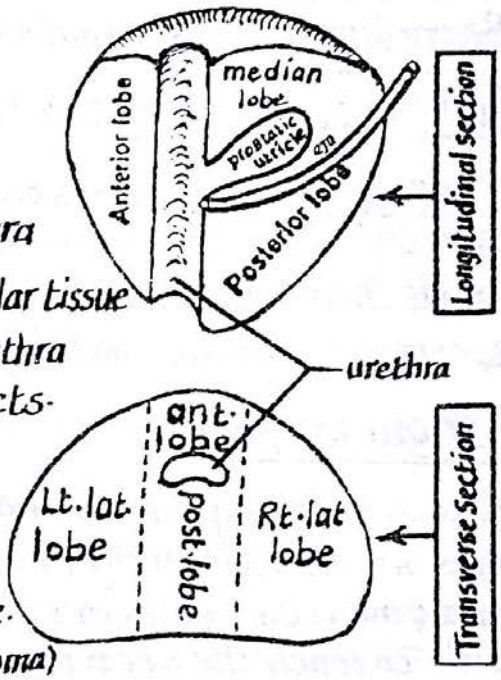
The urethra & the 2 ejaculatory ducts traverse the prostate dividing it into the following 5 lobes:

(1) **Anterior lobe** (isthmus): lying infront of the urethra connecting the 2 lateral lobes. It is formed of fibromusular tissue

(2) **Posterior lobe**: connects the 2 lat. lobes behind the urethra. It lies below & behind the median lobe & ejaculatory ducts.

(3) **Median lobe**:
- lies between the 2 ejaculatory ducts & the urethra
- it pushes the post. wall of the internal urethra meatus upwards into the urinary bladder forming the uvula vesicae.
- it contains much glandular tissue (common site for adenoma)

(4) & (5) **Right & Left lateral lobes**: lie on each side of the urethra



* Structures inside the prostate:

(1) **prostatic urethra**: traverses the prostate along the junction of ant. 1/3 & post. 2/3.
(2) **ejaculatory ducts**: descend downwards, forwards & medially on each side of the median lobe.
(3) **prostatic utricle**: a blind sac ½ cm long extending upwards & backwards into the median lobe. It opens at the middle of the urethral crest. It is the homologue of the uterus in the female (utricle = small uterus).

* **Arterial supply**: by branches from inferior vesical, middle rectal & internal pudendal aa.
* **Venous drainage**: into the prostatic plexus of veins which lies between the true & false capsules & drains into the internal iliac veins

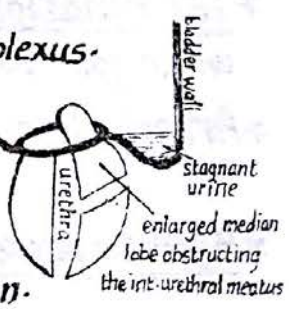
N.B: the prostatic venous plexus receives also:
(1) the deep dorsal vein of the penis.
(2) the Valveless veins of Bateson connecting it with the internal vertebral venous plexus.

* **Lymphatic drainage**: into internal iliac & sacral lymph nodes.
* **Nerve supply**: sympathetic & parasymp. fibres derived from the inf. hypogastric plexus.

Applied anatomy

(1) **Senile enlargment** of the prostate occurs after the age of 50. Affection of median may obstruct the internal urethral meatus causing difficult urination.

(2) **Cancer prostate** spreads to the vertebral column via the valveless veins of Bateson.



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2- DUCTUS (VAS) DEFERENS

*__Definition__: it is a muscular tube, 45 cm long, which transmits the sperms from the epididymis to the prostatic urethra.

*__Characters__: it is cord like having a very thick muscular wall & a narrow lumen.

*__Beginning__: in the scrotum as a continuation of the tail of the epididymis

*__Course & relations__: its course is divided into 3 parts:

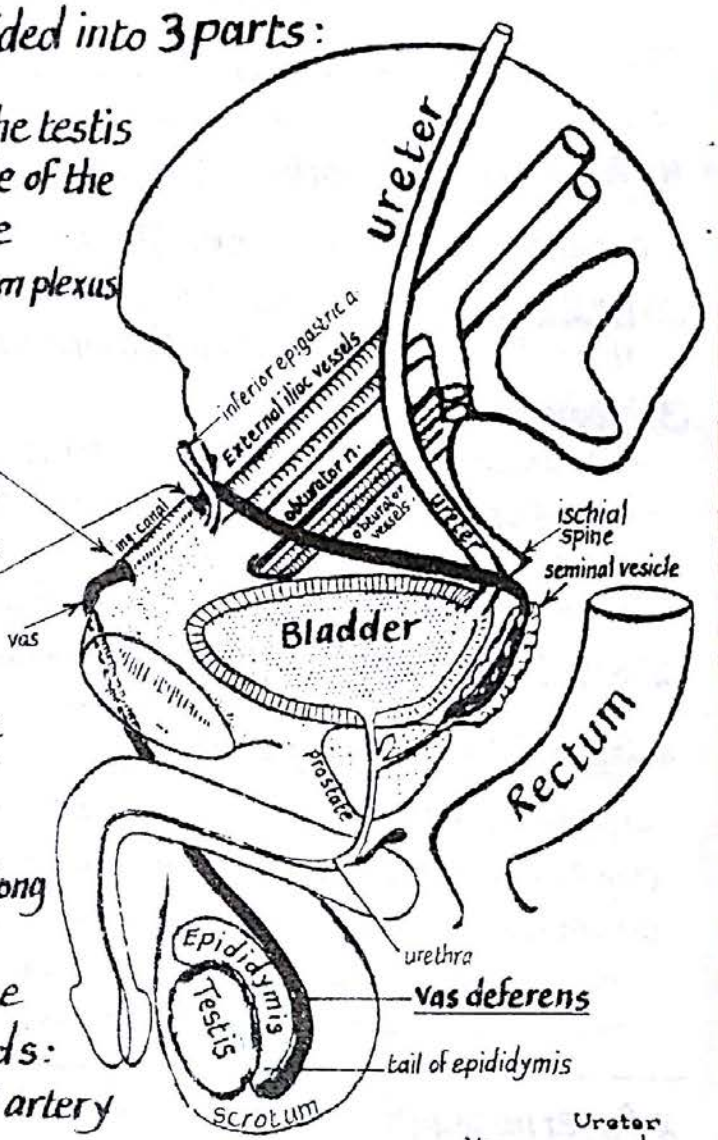
(I) __Scrotal part__: ascends on the back of the testis & medial to the epididymis till the upper pole of the testis then it ascends in the post. part of the spermatic cord, surrounded by the pampiniform plexus

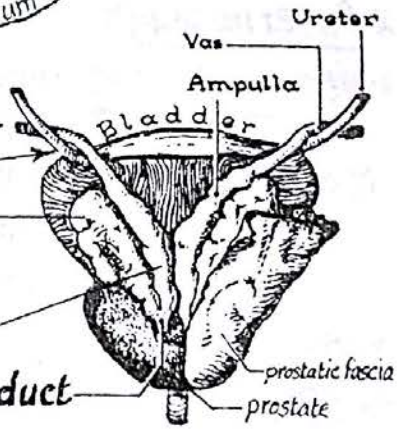
(II) __Inguinal part__:

it enters the superficial inguinal ring, runs upwards & laterally through the inguinal canal (among the constituents of the spermatic cord) to reach the deep inguinal ring.

(III) __Pelvic part__:

- At the deep inguinal ring, the vas leaves the spermatic cord & curves round the lat. side of the inferior epigastric artery.
- then it descends downwards & backwards along the side wall of the side wall of the pelvis (under cover of the peritoneum) & crosses the following structures from above downwards:
(1) ext. iliac vessels (2) obliterated umbilical artery (3) obturator nerve & vessels.
- on reaching the ischial spine, the vas turns 90° medially & downwards crossing over the terminal part of the ureter then turns downwards medial to the seminal vesicle, lying behind the base of the bladder & infront of the rectum.





*__Termination__: it ends by forming a dilatation called ampulla which joins the duct of the seminal vesicle forming the ejaculatory duct

*__Arterial Supply__: by the artery of the vas (br. of inf. vesical a.) which ends by anastomosing with the testicular artery.

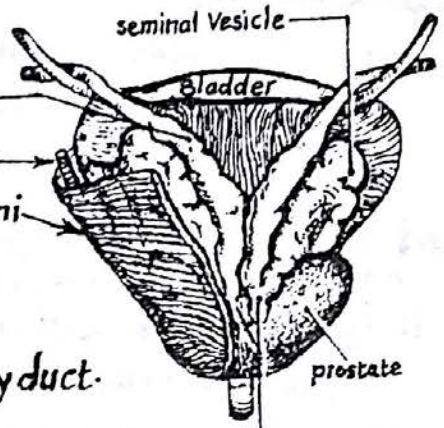
*__Applied anatomy__: male sterilization is done by vasectomy operation where a short segment of the vas is cut through an incision in the upper part of the scrotum.

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3- SEMINAL VESICLES

* **Shape & site:**

Each seminal vesicle is a coiled tube about 5 cm long (15 cm when uncoiled) with a blind upper end. It extends from the termination of the ureter above to base of prostate between the base of the bladder anteriorly & the rectum posteriorly.



* **Relations:**
 - **medially**: the lower end (ampulla) of the vas deferens.
 - **laterally**: (1) Sup. & inf. vesical arteries as they pass to the bladder.
 (2) the prostatic & vesical venous plexuses & levator ani.
 - **posteriorly**: rectum & rectovesical pouch of peritoneum.
 - **anteriorly**: base of the urinary bladder.
 - **below**: it joins the lower end of the vas to form the ejaculatory duct.
* **Arterial Supply**: inferior vesical & middle rectal arteries.

4- EJACULATORY DUCTS

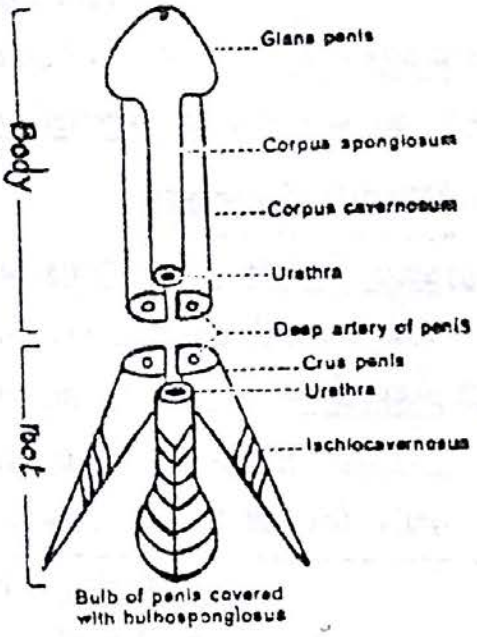
* Each ejaculatory duct is 2 cm long & is formed by the union of duct of the seminal vesicle & the lower end of the ampulla of the vas deferens.
* **Course**: it begins at the base of the prostate then passes downwards, forwards & medially through the prostate (along the side of its median lobe).
* **termination**: by opening on the surface of the seminal colliculus in the middle of the post. wall of the prostatic urethra.

5- The Penis

* **definition**: it is the male organ of micturition & copulation.
* **parts**:

(1) **Root**: it is the attached part of the penis which is situated in the superficial perineal pouch (see page 50).

(2) **Body**:
* it is the free portion which is completely enveloped in skin.
* **structure**: it is formed of (a) erectile tissue. (b) coverings.



(A) **The erectile tissue**: is formed of:

(1) **Corpus spongiosum**:
- it is the forward continuation of the bulb of penis.
- it ends by a conical enlargement called the glans penis.
- throughout its whole extent it is traversed by the urethra.

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(2) **two corpora cavernosa :**

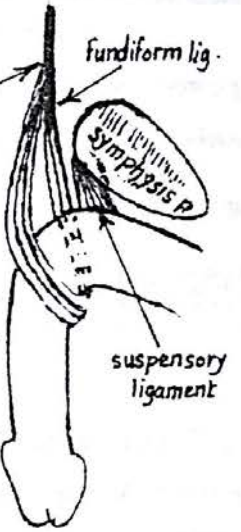
- they are the forward continuation of the crura of the penis.
- they lie in close apposition to each other & end under cover of the glans penis.
- each corpus cavernosus is traversed, throughout its whole length, by the deep a. of penis.

(B) Coverings :

(1) **skin** : thin, elastic, devoid of hairs & loosely attached to the underlying fascia.

(2) **superficial fascia** : 2 layers : (a) superficial layer of loose areolar tissue devoid of fat.
(b) deep membranous layer (fascia penis) which envelops the 3 masses of erectile tissue.

* Ligaments of the penis :



(1) **Fundiform ligament** : arises from the lower end of linea alba & splits into 2 lamellae which encircle the penis & unite below its body

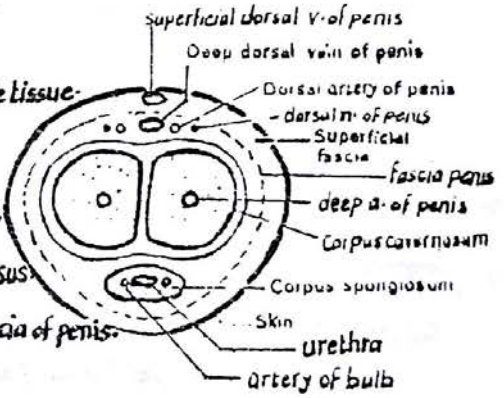
(2) **Suspensory lig. of the penis** : is triangular in shape. It is attached above to the front of symphysis pubis & below to the body of penis.

* Nerve supply of penis :

(1) **Sensory** : dorsal n. of penis (br. of the pudendal n.)
ilio inguinal nerve

(2) **Autonomic** : parasympathetic : from the pelvic splanchnic n. (S 2,3,4).
sympathetic : from the pelvic plexus.

* Arterial Supply : 3 branches from each int. pudendal a.



(1) **deep a. of penis** : runs in the corpus cavernosum & supplies its erectile tissue.

(2) **dorsal a. of penis** : runs on the dorsum of penis (beneath the fascia penis) & supplies the glans penis.

(3) **artery of bulb** : supplies the bulb & proximal ½ of corpus spongiosus.

N.B : the superficial ext. pudendal br. of femoral a. supplies skin & fascia of penis.

* Venous drainage :

(1) **superficial dorsal V. of penis** : runs on the dorsum of penis, in the median plane (superficial to the fascia penis). It divides into 2 branches which join the superficial ext. pudendal veins of the 2 sides.

(2) **deep dorsal V. of penis** : runs on the dorsum of peins, in the median plane (deep to the fascia penis). It passes through the gap between the perineal membrane & the lower border of symphysis pubis to enter the pelvis where it ends in the prostatic plexus of veins.

(6) **Bulbo-urethral (Cowper's) gland** : see page 52.

(7) **Testis & epididymis** : see abdomen (page 27).

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FEMALE GENITAL ORGANS

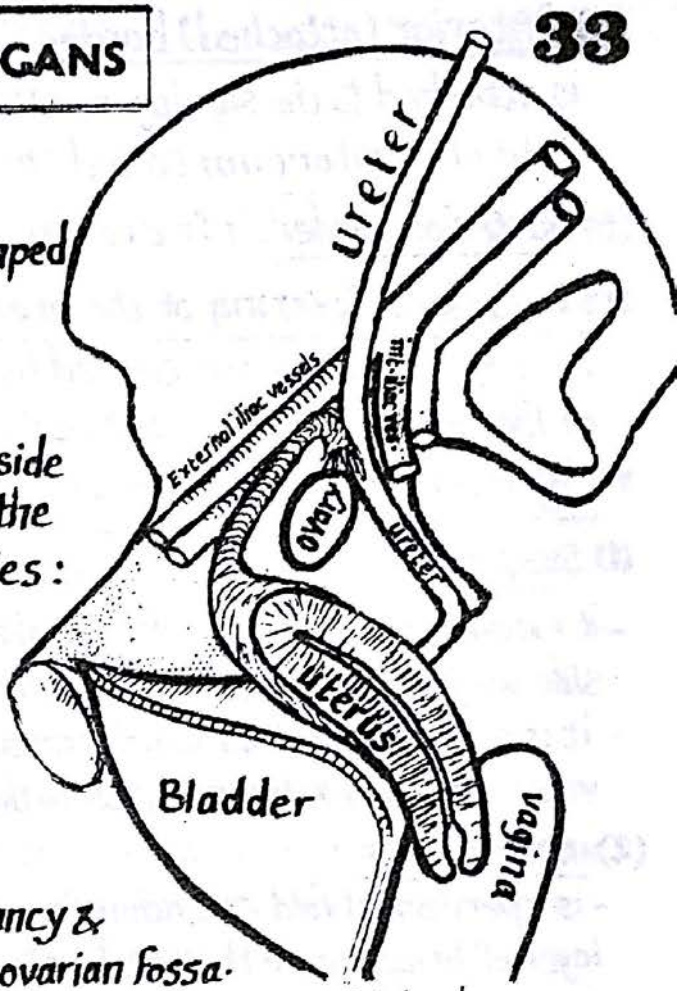
OVARY

* **Shape & Size** : each ovary is almond-shaped organ measuring —— 3 cm in length
 2 cm in breadth
 1 cm in thickness

* **Site** : in the nulliparous woman, it lies on the side wall of the lesser pelvis in a depression called the **ovarian fossa** which has the following boundaries :

(1) infront & above : external iliac vessels.
(2) behind : ureter & internal iliac vessels.

N.B : (1) the ovary is attached to the sup. surface of the broad lig. in close relation to the lat. end of the Fallopian tube.
(2) the ovary is displaced in the first pregnancy & never returns to its original site in the ovarian fossa.

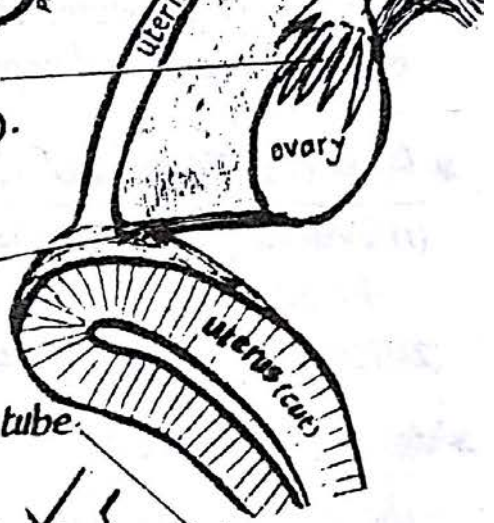


* **General Features** : the ovary has —— 2 ends
 2 surfaces
 2 borders



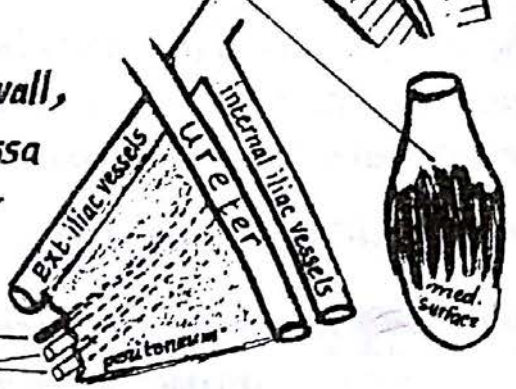
(1) **Tubal (upper) end** :
is directed upwards & gives attachment to :
(a) the ovarian fimbria of the Fallopian (uterine) tube.
(b) the suspensory lig. of the ovary (infundibulo-pelvic lig.).

(2) **Uterine (Lower) end** :
directed downwards & is attached to the lateral angle of the uterus by the ovarian ligament



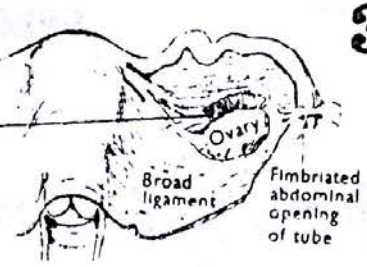
(3) **Medial Surface** :
directed medially & covered by the fimbriated end of uterine tube.

(4) **Lateral Surface** :
- is directed laterally towards the lateral pelvic wall, in contact with the peritoneum of the ovarian fossa
- is related to obturator n. & vessels in the floor of the fossa.



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(5) **Anterior (attached) border**:
is attached to the sup. layer of the broad lig. by a short fold of peritoneum called the **mesovarium**.



(6) **posterior border**: is free border directed backwards.

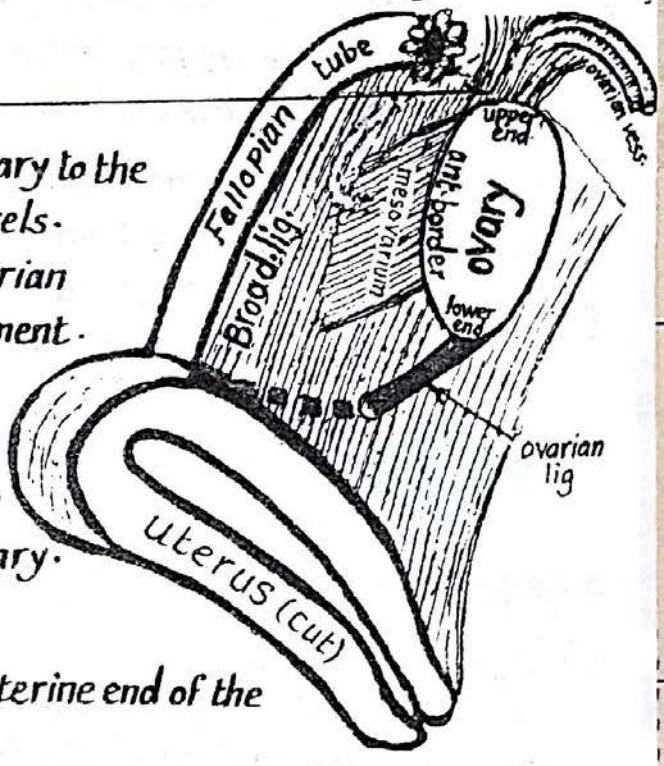
* **Peritoneal Covering of the ovary**:
the ovary is completely covered by peritoneum except at the line of attachment of the mesovarium. The peritoneal covering is perforated by the ovum during ovulation.

* **Ligaments of the ovary**:

(1) **Suspensory ligament of the ovary**
- it extends laterally from the tubal end of the ovary to the side wall of the pelvis at the external iliac vessels.
- it is a peritoneal fold which transmits the ovarian vessels, nerves & lymphatics to the broad ligament.

(2) **mesovarium**:
- is a peritoneal fold extending from the upper layer of broad lig. to the ant. border of the ovary.
- it transmits the ovarian vessels & nerves to the ovary.

(3) **Ovarian ligament**:
- it is a fibromuscular cord extending from the uterine end of the ovary to the lateral angle of the uterus.



* **Arterial Supply of the ovary**:
(1) **Ovarian artery**: arises from the abd. aorta. It enters the suspensory lig. then the broad lig. to reach the ovary via its mesovarium. (see abdomen p.96 for details).
(2) **Uterine artery**: gives additional brs. which reach the ovary through the mesovarium.

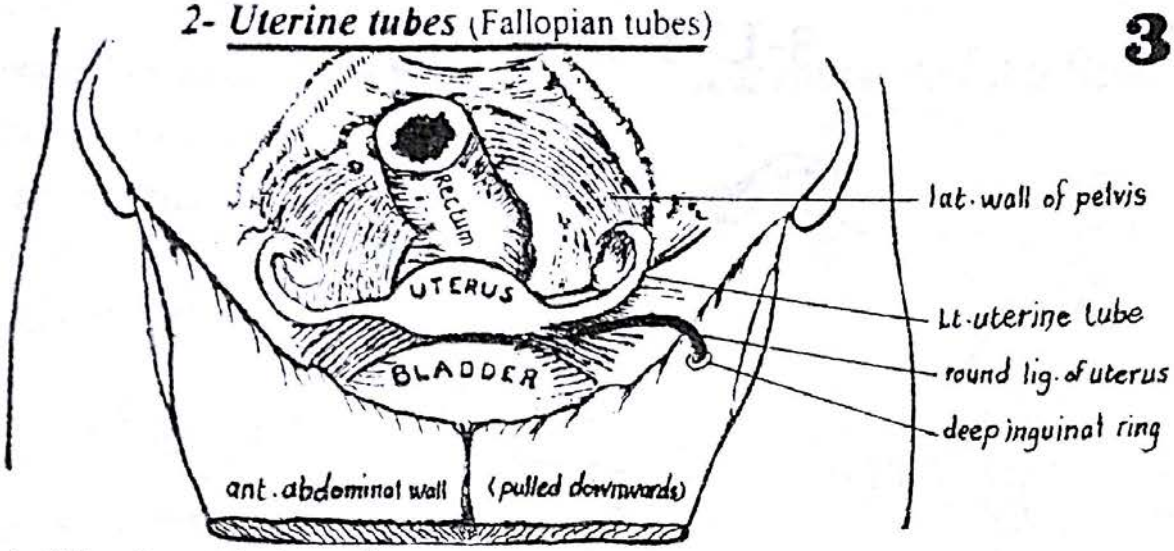
* **Venous drainage**:
- the veins draining the ovary form a pampiniform plexus which rapidly form ovarian vein that accompany the ovarian artery.
- the Rt. ovarian v. ends in the I.V.C while the Lt. vein ends in the Lt. renal v.

* **Lymphatic drainage**: into the para-aortic lymph nodes.

* **Nerve supply**: (a) Sympathetic fibres: from T 10, 11.
(b) parasympathetic " : from S 2, 3, 4.

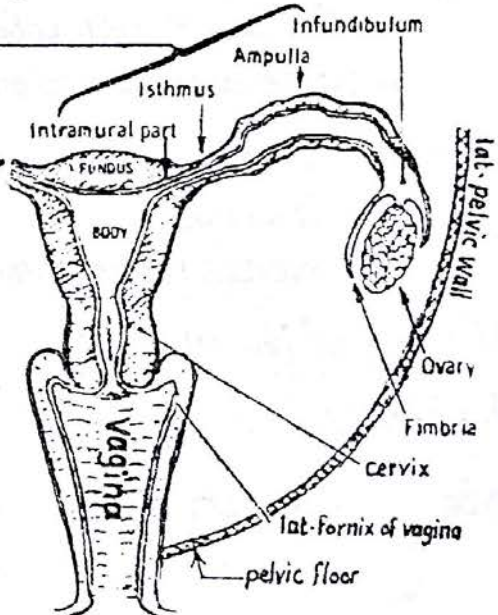
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2- Uterine tubes (Fallopian tubes)



* **Size**: each Fallopian tube is 4" (10 cm) long.
* **Site**: each tube extends laterally from the sup. angle of the uterus to the ovary on the side wall of the pelvis. It lies in the ant. free margin of the broad lig.
* **Course & relations**:
 - each tube runs upward laterally & backwards from the uterus to the side wall of pelvis
 - then it curves backwards piercing the upper layer of the broad lig. to end on the med. surface of the ovary by a funnel shaped expansion called the infundibulum.
 - along its whole course it is related to coils of ileum & sigmoid colon.

* **Parts of the uterine tube**:



(1) **Uterine or intramural part**: (1 cm):
- it is the most medial, narrowest & shortest part (1cm).
- it penetrates the superolateral angle of the uterus.

(2) **Isthmus**: (3 cm).
- lies just lat. to the uterus & forms the lat. 1/3 of the tube.
- it is narrow, rounded & cord like.

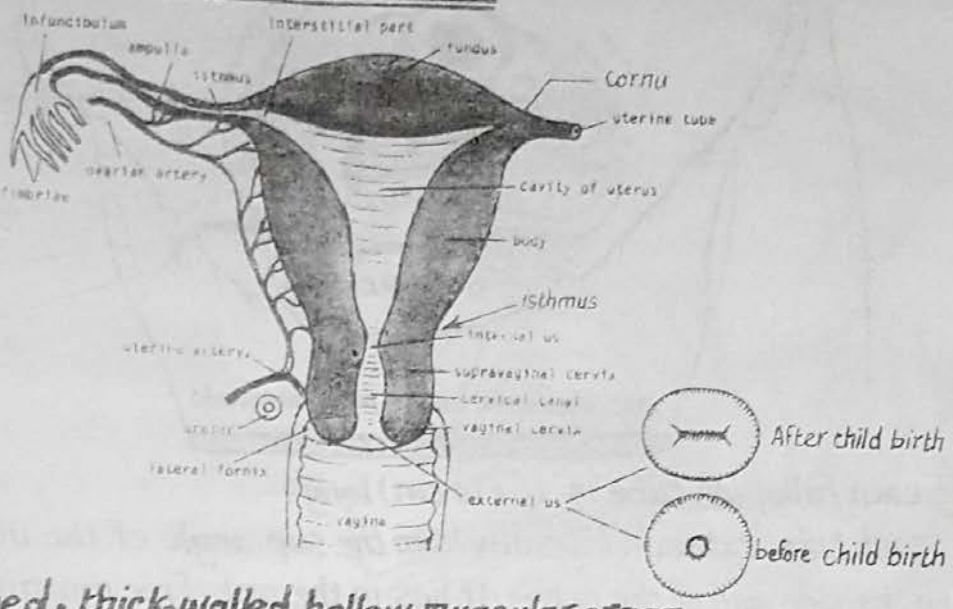
(3) **Ampulla**: (5 cm):
- lies lateral to the isthmus & forms the lat. 1/2 of the tube.
- it is thin-walled, tortuous & widest part of the tube.

(4) **Infundibulum** (fimbriated end):
- it is the funnel-shaped lat. end of the tube which opens into the peritoneal cavity
- its circumference is prolonged into a number of fimbria, one of which is large & attached to the ovary (ovarian fimbria. The fimbria guide the ovum to the interior of the tube.

* **Arterial Supply**: (a) med. 3/4 : by the uterine a.
 (b) lat. 1/4 : by the ovarian a.
* **Lymphatic drainage**: (a) most tubal lymphatics pass to the lat. aortic & preaortic L.Ns.
 (b) lymphatics of the isthmus drain into the superficial inguinal L.Ns.
* **Applied anatomy**: (1) infection may spread from the tube to the peritoneal cavity → peritonitis.
 (2) tubal obstruction by fibrosis is a major cause of female sterility.

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3-UTERUS



* **Shape**: pear-shaped, thick-walled hollow muscular organ.
* **Size**: 3" long, 2" wide & 1" thick.
* **Structure**: it is formed of 3 parts: Fundus, body & cervix:

(1) **Fundus**: is the dome-shaped upper part above the level of the enterance of uterine tubes. It is convex in all directions.

(2) **Body**: is the part extending from the level of the opening of uterine tubes to the constriction called the **isthmus**. The fundus & body are 2" long

N.B: the superolateral angle of the body, at its junction with the tube is called **Cornu**.

(3) **Cervix**: is the part below the isthmus (one inch long). It is cylindrical in shape. Its upper half lies above the vagina (supravaginal part) while its lower ½ pierces the ant. wall of the vagina & projects inside it (called **vaginal part**).

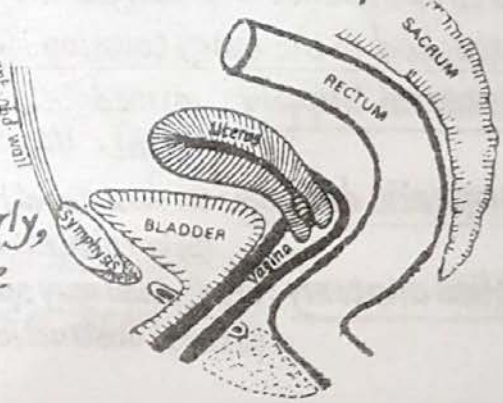
* Cavity of the uterus:

(1) **Cavity of the body**: is slit-like in sagittal section but triangular in coronal section with the apex of the triangle lying at the internal os of the cervix.

(2) **Cavity of the cervix**: (cervical canal): is fusiform in shape & communicates with:
- above with the uterine cavity through the **Internal os**.
- below with the vaginal cavity through the **External os** which is small & rounded before child birth but becomes slit-shaped after child birth.

* Normal position of the uterus:

- the uterus lie in the cavity of the lesser pelvis between the rectum posteriorly & the bladder anteriorly, being deflected either to the Rt. or to the Lt. of the median plane.

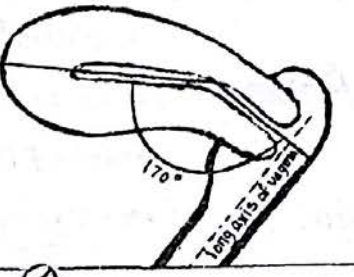


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(2) the anatomical position of the uterus is described as anteverted anteflexed:

(a) anteverted means that the whole uterus forms nearly a right angle with the long axis of the vagina.

(b) anteflexed means that the long axis of the body forms an angle about 170° with the long axis of the cervix



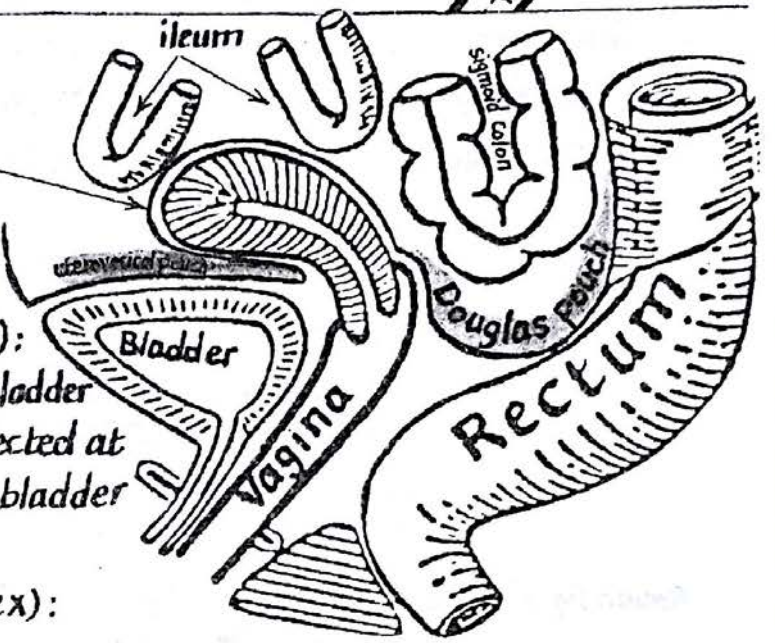
* Relations of the Uterus:

(A) **Fundus**: covered with peritoneum & is related to coils of ileum

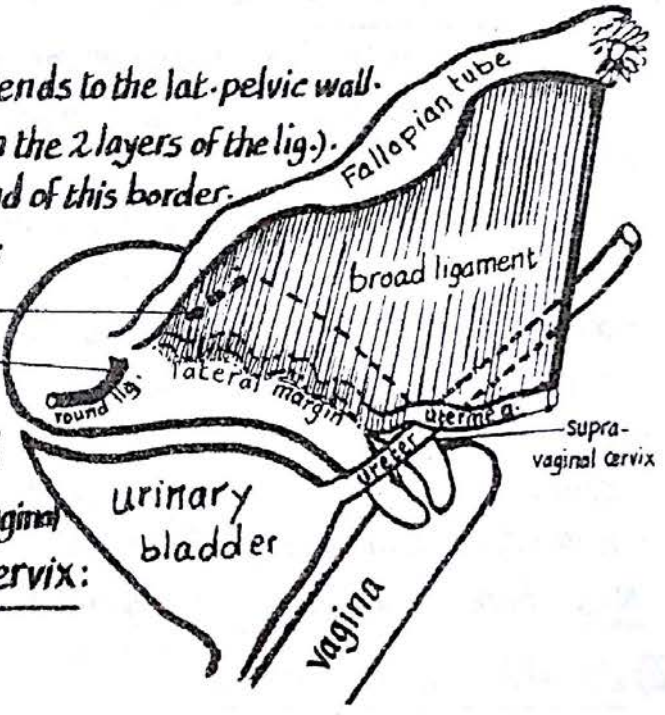
(B) **Body**: has ant. & post. surfaces:

(1) anterior (vesical) surface: (flattened):
- it is related to the upper surface of the bladder
- it is covered with peritoneum which is reflected at the isthmus on to the upper surface of the bladder forming the uterovesical pouch.

(2) posterior (intestinal) surface: (convex):
- it is related to coils of ileum & sigmoid colon.
- it is covered with peritoneum which extends to the back of the cervix & upper part of the vagina then reflected backward on to the rectum forming the Douglas pouch



(3) Lateral margin: (rounded):
- it gives attachment to the broad lig. which extends to the lat. pelvic wall.
- the uterine a. ascends along this margin (between the 2 layers of the lig.).
- the uterine tube enters the uterus at the upper end of this border.
- the upper part of lat. border gives attachment to:
 (a) the ovarian ligament: behind uterine tube
 (b) round lig. of the uterus: infront of » »



(C) Cervix of the uterus

- it is cylindrical in shape & has 2 parts { vaginal / supravaginal }

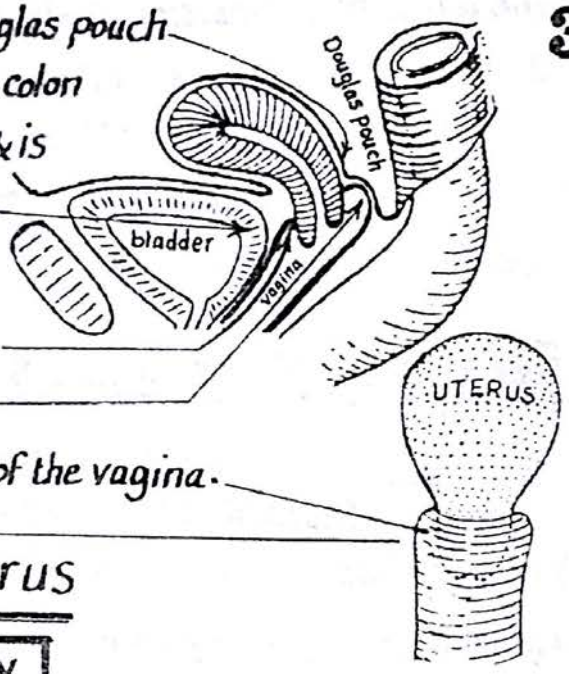
(1) Relations of the supravaginal part of the cervix:

(a) **Laterally**: it is related to
 (1) the uterine artery.
 (2) the ureter (runs downwards & forwards 2 cm lat. to the cervix).
 (3) parametrium: dense C.T between the 2 layers of the broad lig.

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(b) Posteriorly : it is covered by peritoneum of Douglas pouch & related to coils of ileum & sigmoid colon

(c) Anteriorly: it is not covered by peritoneum & is related to the urinary bladder



(2) Relations of the Vaginal part of the cervix :

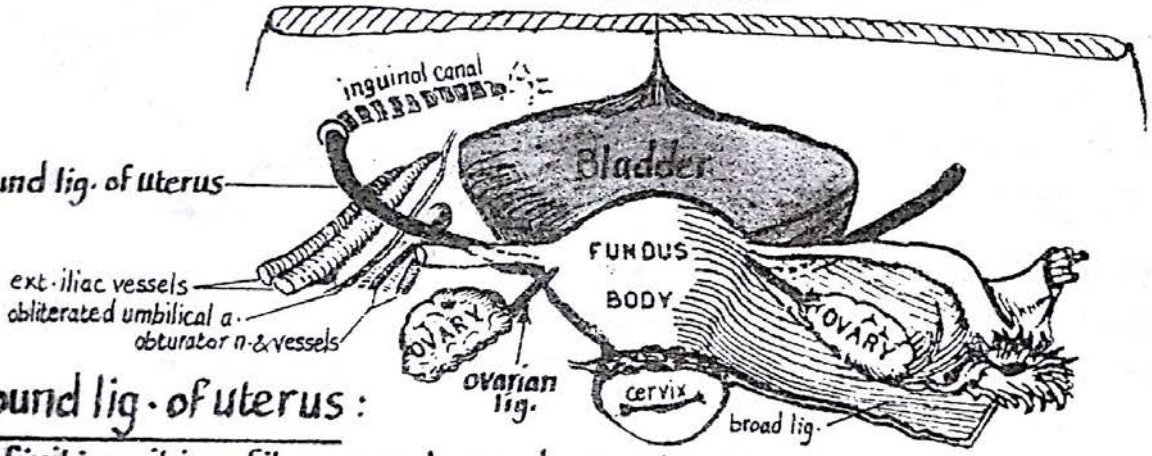
(a) Anteriorly : anterior fornix of the vagina

(b) posteriorly : posterior fornix of the vagina

(c) on each side : it is related to lateral fornix of the vagina.

Ligaments of the uterus

I- Ligaments of the body



(1) Round lig. of uterus :

* Definition: it is a fibromuscular cord extending from the cornu of the uterus to the labium majus. It represents the lower part of the gubernaculum in the foetus.

* Course & relations :

- it is attached to the upper end of lat. margin of the body of uterus infront of the uterine tube.
- it runs forwards & laterally between the 2 layers of the broad lig, below the uterine tube.
- on the lat. pelvic wall, it crosses over the obturator n. & vessels, obliterated umbilical a. & external iliac vessels (the same structures crossed by the vas deferens in the male).
- it enters the deep inguinal ring (just lat. to inf. epigastric a.), traverses the inguinal canal (having the same covering as spermatic cord in the male)
- it emerges from the superficial ring & ends in the subcutaneous tissue of the labium majus.

N.B : there are 2 other round ligaments in the body : (1) round lig. of liver (2) round lig. of femur.

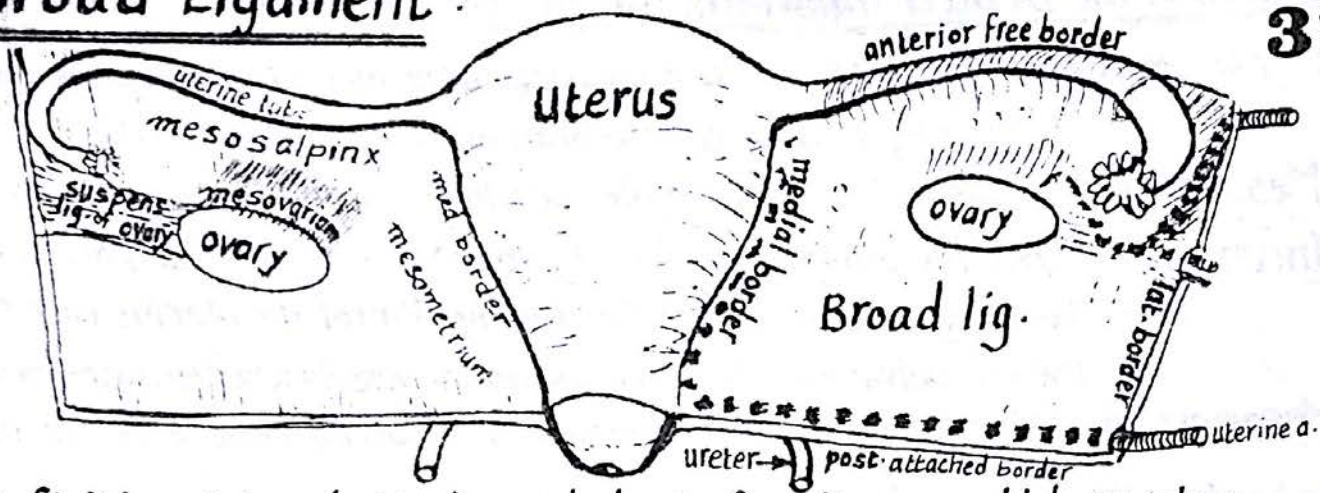
(2) the Ovarian ligament :

* Definition : it is a short fibromuscular cord representing the upper part of the gubernaculum.

* Course : it passes, within the broad lig., from the uterine end of the ovary to the cornu of the uterus behind the enterance of the uterine tube.

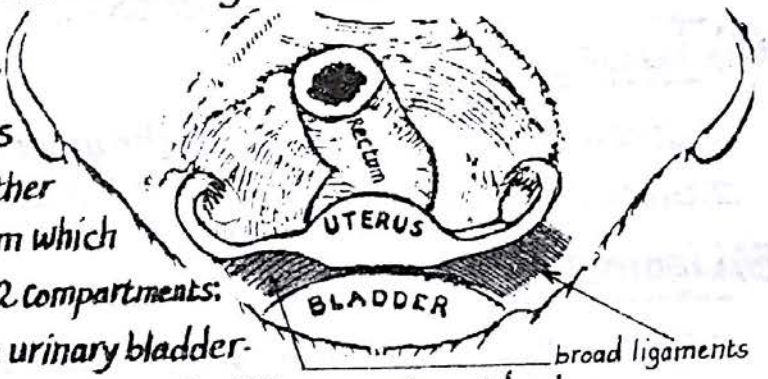
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(3) Broad Ligament :



* **Definition**: it is a double-layered sheet of peritoneum which stretches transversely in the pelvic cavity from the lat. margin of the uterus to the side wall of the pelvis.

* **Shape**: quadrilateral having { 4 borders / 2 surfaces }



* **Relations**: the 2 broad ligaments together with the uterus form a transverse septum which divides the cavity of the lesser pelvis into 2 compartments:
 (a) anterior compartment : containing the urinary bladder.
 (b) posterior " : containing the rectum, coils of ileum & sigmoid colon.

* **Surfaces**:
 (1) upper (intestinal) surface : { directed upwards & backwards / related to coils of ileum & sigmoid colon / its upper layer is pierced by the lat. end of uterine tube. }
 (2) Lower (vesical) surface : directed downwards & forwards towards the urinary bladder.

* **Borders** : it has 4 borders :

(1) **anterior free border** where the 2 layers of the lig. are continuous with each other around the med. 4/5 of the uterine tube. The lat. 1/5 of this border forms the infundibulopelvic lig.

(2) **posterior attached border** : is attached to the pelvic floor where the 2 layers of the lig. diverge from each other. The uterine vessels run along this border (between the 2 layer) & the ureter crosses below the attached border 2 cm lat. to the cervix.

(3) **medial border** : attached to the lat. border of the uterus where the 2 layers separate to enclose the uterus. The uterine vessels ascend along this border (between the 2 layers).

(4) **lateral border** : attached to the side wall of the true pelvis where it crosses the following structures from above downwards :
(a) external iliac vessels (b) obliterated umbilical a. (c) obturator nerve & vessels.

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* Parts of the broad ligament :

(1) **Mesovarium**: it is a peritoneal fold connecting the ovary to the sup. layer of broad lig. It transmits the ovarian vessels & nerves to the ovary.

(2) **Mesosalpinx** : is the part between the uterine tube & the attachment of mesovarium.

(3) **Infundibulopelvic lig.** (suspensory lig. of ovary) : is the upper lat. part of the broad lig. extending from the infundibulum of the uterine tube to the lat. pelvic wall. It transmits ovarian vessels & nerves to the mesovarium

(4) **Mesometrium** : is the remaining greater part of the broad lig. close to the uterus.

* Contents of the broad lig. (between the 2 layers) : 2 tubes, 2 ligaments, 2 arteries, 2 embryological remnants & parametrium

(A) Tubes :

(1) uterine tube : is enclosed in the anterior free border of the ligament.

(2) ureter : runs forwards & medially below the root of broad lig. 2 cm lat. to the cervix.

(B) Ligaments :

(1) Ovarian lig. : its proximal part lies between the 2 layers of the broad lig.

(2) round lig. of the uterus : its proximal part lies between the 2 layers of the broad lig.

(C) Arteries :

(1) ovarian a. : passes through the suspensory lig. of ovary to the mesosalpinx then enters the mesovarium to reach the ovary.

(2) uterine a. : passes first medially in the post. attached border (root) of the broad lig. (crossing above the ureter 2 cm lat. to the cervix), then ascends in the med. border of the lig. & finally turns laterally in the mesosalpinx below the uterine tube.

(D) Embryological remnants

(1) Epoophoron : about 15-20 rudimentary tubules present in the lat. part of the broad lig. above the attachment of the mesovarium.

(2) Paroophoron : few scattered tubules lying in the broad lig. medial to the attachment of the mesovarium.

N.B : both epoophoron & paroophoron are the embryological remnants of the mesonephric duct & tubules of the embryo.

(E) **Parametrium** : a dense fibrofatty C.T between the 2 layers of the broad lig & contains :

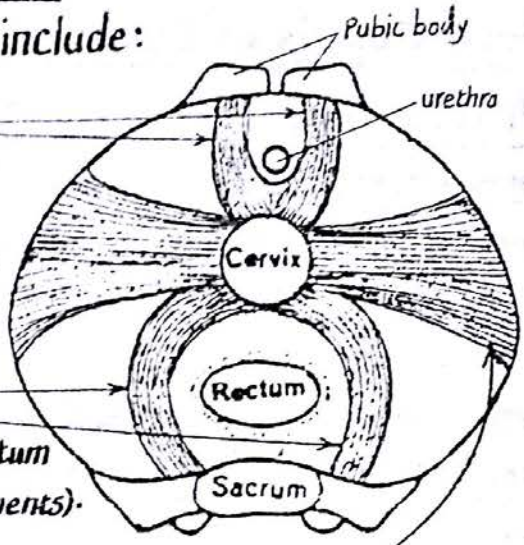
(1) uterovaginal & ovarian plexuses of nerves

(2) lymphatics & lymph nodes.

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II- Ligaments of the Cervix

They are condensation of the endopelvic fascia & include:



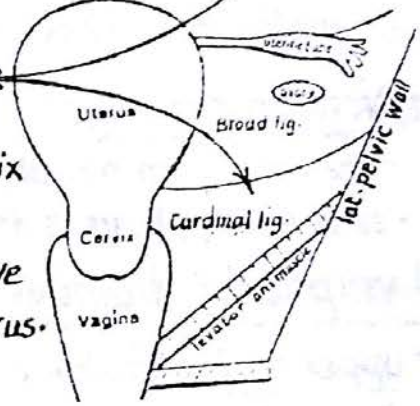
(1) Pubocervical ligaments:

- they extend from the cervix & upper part of the vagina around the sides of the urethra to the post. surface of the pubis. They correspond to puboprostatic ligs. in ♂.

(2) Uterosacral ligaments:

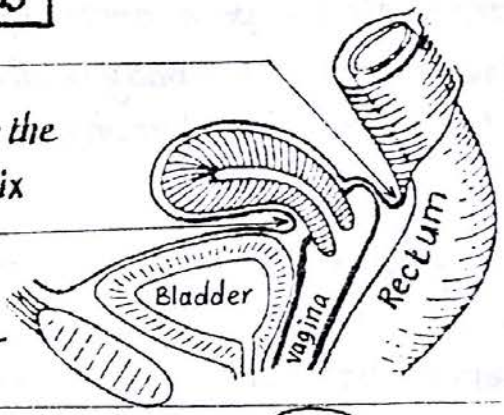
- they extend from the cervix around the sides of the rectum to the periosteum of the front of sacrum (2nd & 3rd segments).
- they are enclosed within the recto-uterine folds of peritoneum.

(3) Transverse cervical (Cardinal or Mackenrodt's) ligaments:



- each lig. extends laterally from the side of the cervix & lat. fornix of vagina to be attached to the side wall of the pelvis.
- they are strong fan-shaped condensations of the pelvic fascia above levator ani m. & are very important factor in the support of the uterus.

III- Peritoneal ligaments of the uterus



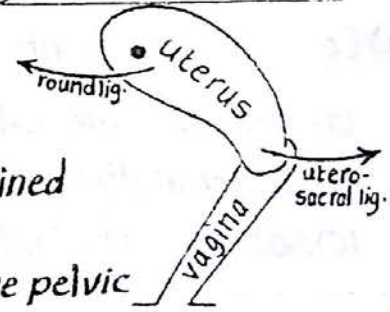
(1) Posterior Ligament:

it is the recto-uterine fold of peritoneum extending from the front of rectum to post. fornix of vagina & supravaginal cervix

(2) Anterior ligament:

it is the uterovesical fold of peritoneum extending from the front of the cervix to the upper surface of the bladder

Factors maintaining the position of the uterus



(1) **uterine axis**: the anteverted position of the uterus prevents it from sagging down through the vagina. This anteversion is maintained by the pull of the uterosacral & round ligaments.

(2) **Ligaments** of the body & cervix which connect the uterus to the pelvic walls; the stongest is the transverse (Mackenrodt's) ligament.

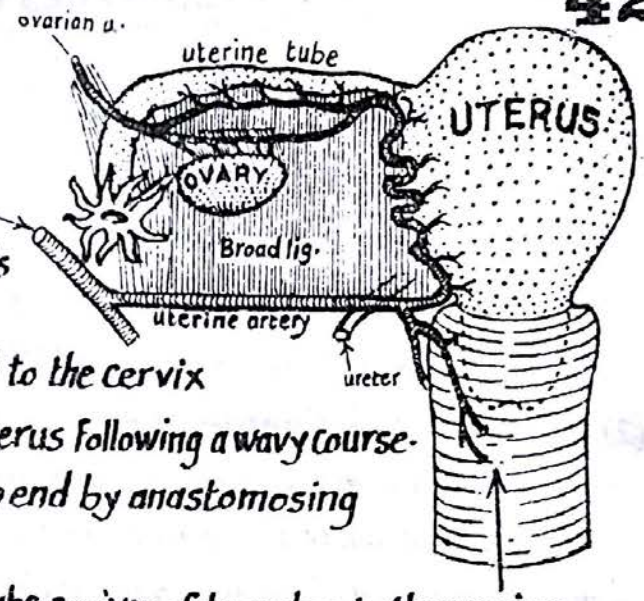
(3) **Pelvic floor muscles** (pelvic diaphragm): it supports pelvic organs by resisting their downward push during increased inta-abdominal pressure

(4) **uro-genital diaphragm**: the muscles of the deep perineal pouch (see page 52)

(5) **perineal body**: it is a fibromuscular node between the vagina & anal canal, receiving the insertions of all perineal muscles & thus maintains the integrity of the pelvic floor.

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* Blood Supply of the uterus:



(1) Arterial Supply: the uterine artery:

- arises from the ant. division of internal iliac a.
- runs at first medially on the floor of the pelvis in the root of the broad ligament.
- it crosses above the ureter about 2 cm lateral to the cervix
- then it ascends along the side of the body of uterus following a wavy course.
- Finally it turns laterally below the uterine tube to end by anastomosing with the ovarian artery
- it supplies the uterus, med. 3/4 of the uterine tube & gives of branches to the vagina.

(2) Venous drainage:

- the veins draining uterus form 2 venous plexuses along the 2 lat. borders of uterus.
- each venous plexus is drained by a pair of uterine veins which end in the internal iliac v.

* Lymphatic drainage:

(1) upper part of the body + fundus + uterine tube: drain into the para-aortic Lymph nodes.

(2) lower part of the body of uterus: drain into the external iliac lymph nodes.

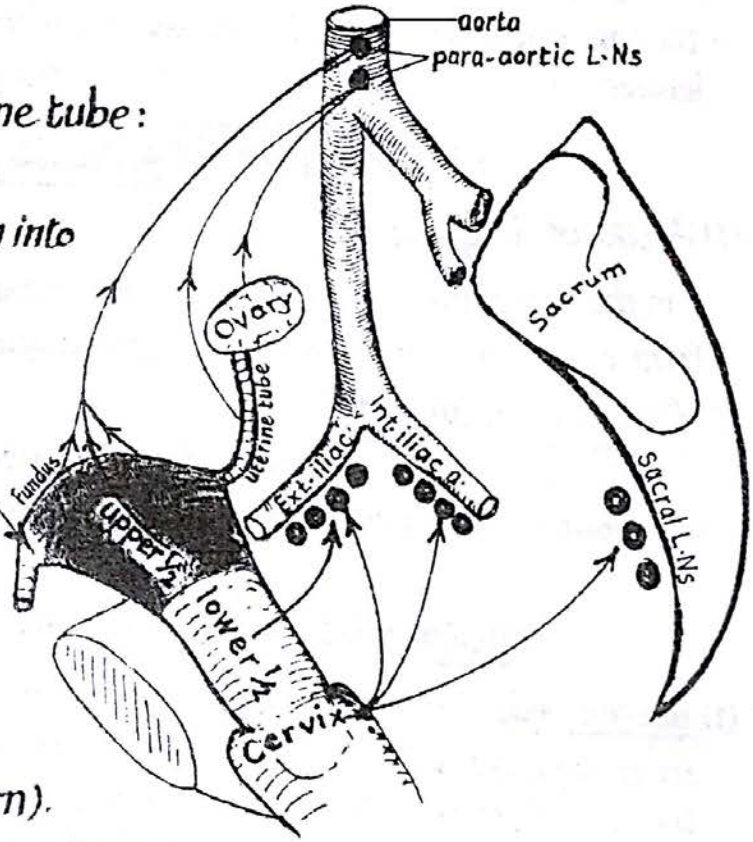
(3) Cornu of the uterus: its lymphatics pass along the round lig. of the uterus to drain into the superficial inguinal lymph nodes.

(4) Cervix: drains into 3 groups of LNs:

(a) internal iliac L.Ns.

(b) external iliac L.Ns.

(c) sacral L.Ns (infront of the sacrum).



* Nerve Supply of the uterus:

(1) sympathetic fibres: from T12 & L1: produce uterine contraction & vasoconstriction.

(2) parasympathetic " : from S 2,3,4: produce uterine relaxation & vasodilatation.

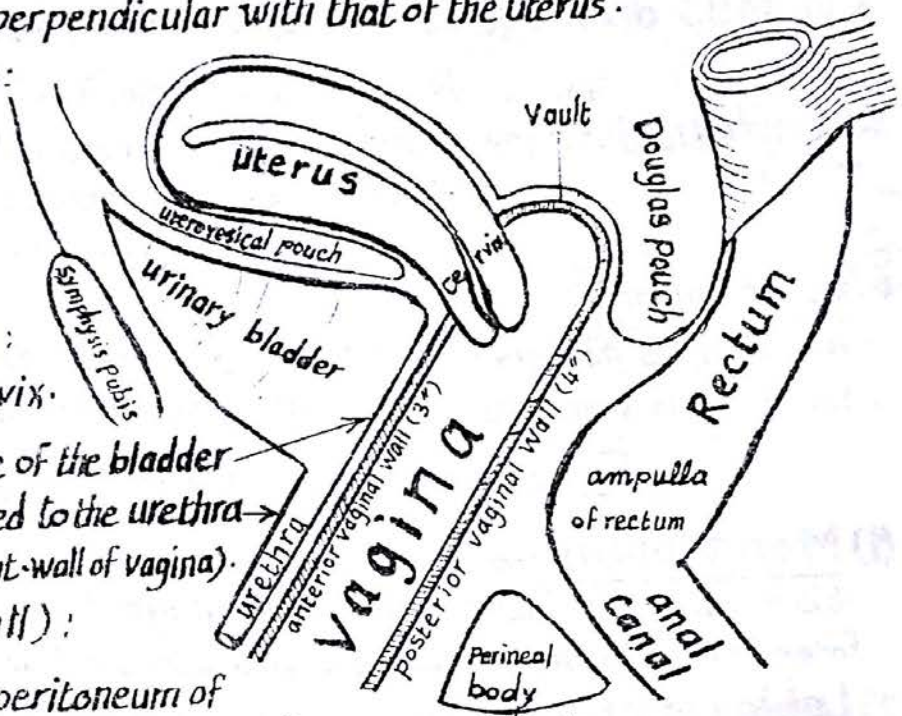
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The vagina

* **Definition**: it is a fibromuscular tube lined by non-keratinized stratified squamous epithelium, forming the female copulatory organ (vagina=sheath).

* **Site**: it extends upwards & backwards from the pudendal cleft (the cleft between the 2 labia minora) to end by surrounding the vaginal part of the cervix. The long axis of the vagina is nearly perpendicular with that of the uterus.

* **Shape**: a tube having 2 walls:
 (a) ant. wall: 3" long
 (b) post. wall: 4" long.

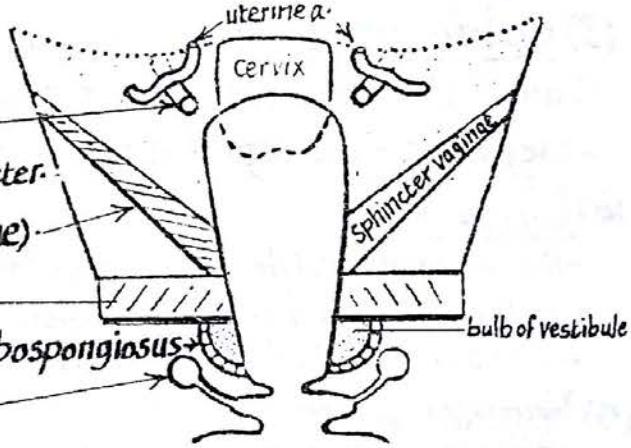


* Relations

(1) **Anteriorly**: (its ant. wall):
 (a) upper 1/3: is pierced by the cervix.
 (b) middle 1/3: is related to the base of the **bladder**
 (c) lower 1/3: is intimately related to the **urethra** (which is embedded in ant. wall of vagina).

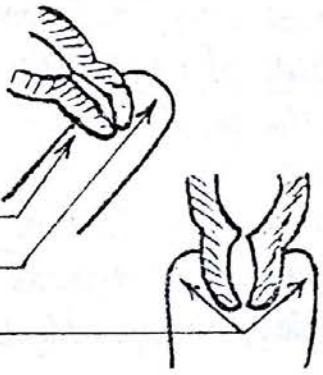
(2) **Posteriorly**: (its post. wall):
 (a) upper 1/4: is covered by the peritoneum of **Douglas pouch** & is related to coils of ileum & sigmoid colon
 (b) middle 2/4: related to the lower 1/3 of **rectum** (separated from it by loose areolar tissue).
 (c) lower 1/4: related to the **perineal body** which separates the vagina from the anal canal.

(3) **Laterally** (on each side):
 (a) upper part (lat. fornix): is related to the **ureter** & to the **uterine a.** as it crosses above the ureter.
 (b) middle part: related to levator ani (**sphincter vaginae**)
 (c) lower part: traverses the **deep perineal pouch** & is related to the bulb of vestibule, bulbospongiosus m. & to the **greater vestibular gland**



* Fornices of the Vagina:

the interior of the upper end of vagina (vaginal vault) is converted by the protruding cervix (vaginal part) into a circular groove.
- the ant. part of that groove is shallow & called the **ant. fornix**.
- the post. " " " " " deep & called the **post. fornix**
- on each side of the cervix there is a **lateral fornix**

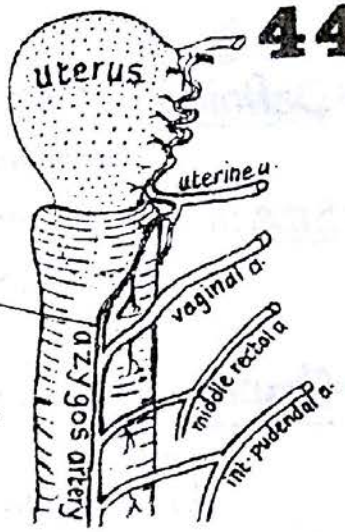


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***Arterial Supply** : the vagina is supplied by branches from:

(1) vaginal a.
(2) uterine a.
(3) middle rectal a.
(4) int.pudendal a.

} the branches supplying the vagina anastomose together forming an anterior & a post.middle line vessels on the ant.& post.vaginal walls called **Vaginal azygos arteries**

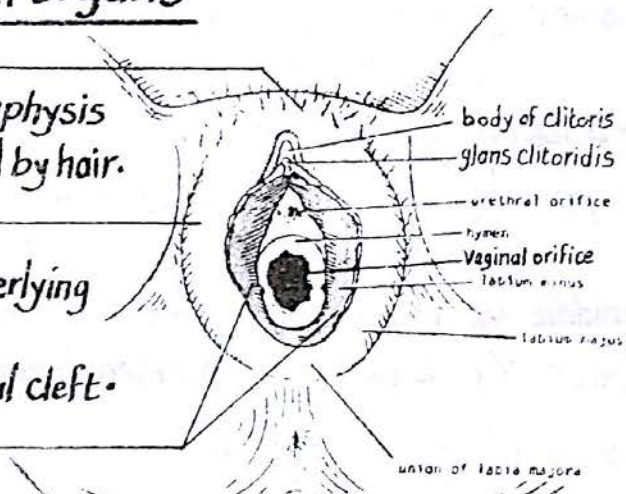


***Venous drainage** : the vaginal veins form plexuses at the sides of the vagina which drain into int.iliac veins.

***Lymphatic drainage** :
- upper 1/3 → external iliac L.Ns.
- middle 1/3 → internal iliac L.Ns.
- lower 1/3 → superficial inguinal L.Ns.

***Nerve Supply**:
- upper 2/3 is pain insensitive & supplied by autonomic fibres { sympathetic: L1,2. / parasymp.: S2,3.
- lower 1/3 is pain sensitive & supplied by pudendal n.

Female external genital organs



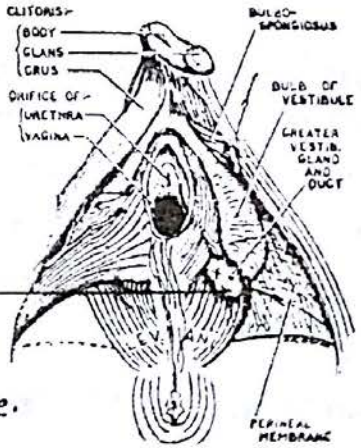
(1) Mons pubis :
it is a rounded eminence infront of pubic symphysis formed by underlying subcutaneous fat & covered by hair.

(2) Labia majora :
- are 2 thick elongated skin folds caused by underlying fat & covered by hair.
- they form the lateral boundaries of the pudendal cleft.

(3) Labia minora :
- are 2 thin skin folds devoid of fat & hair.
- they enclose the vaginal vestibule which contains vaginal & urethral orifices.

(4) Clitoris :
- it is a small erectile organ, homologus with the penis, but is not traversed by the urethra.
- its body is formed of only 2 corpora cavernosa enclosed in a fibrous sheath.
- its free end is called glans clitoridis (very sensitive & plays important role in sexual responses).

(5) Vaginal orifice :
a median slit just below & behind the external urethral orifice.



(6) Bulb of Vestibule (the homologue of the bulb of the penis) :
2 elongated masses of erectile tissue situated on the perineal membrane, one on each side of the vaginal orifice.

(7) Greater vestibular glands (Bartholin glands) :
2 small rounded glands, one on each side of the vaginal orifice & is partially overlapped by the post.ends of lat.masses of bulbs of vestibule.

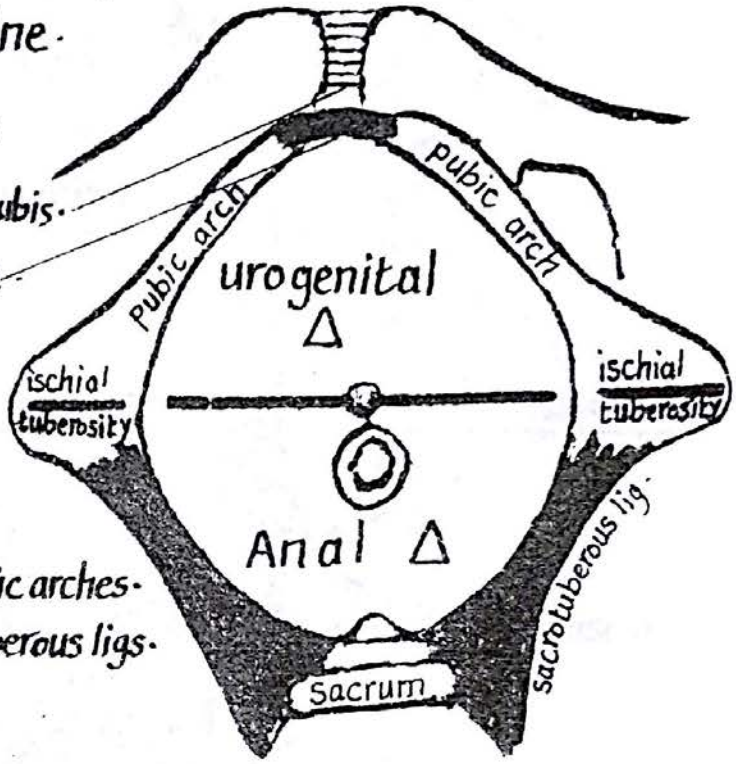
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PERINEUM

* **Definition** : it is the region which overlies the pelvic outlet.
* **Shape** : it has a diamond-shaped outline.
* **Boundaries** : it has 4 borders & 4 angles

(A) **Angles** :

- **ant-angle** : formed by { lower border of sym. pubis / inf. pubic ligament
- **post-angle** : formed by the tip of coccyx.
- **2 lat-angles** : formed by ischial tuberosities



(B) **Borders** :

- 2 anterolateral borders : formed by the pubic arches.
- 2 posterolateral borders : formed by sacrotuberous ligs.

* Divisions of the perineum

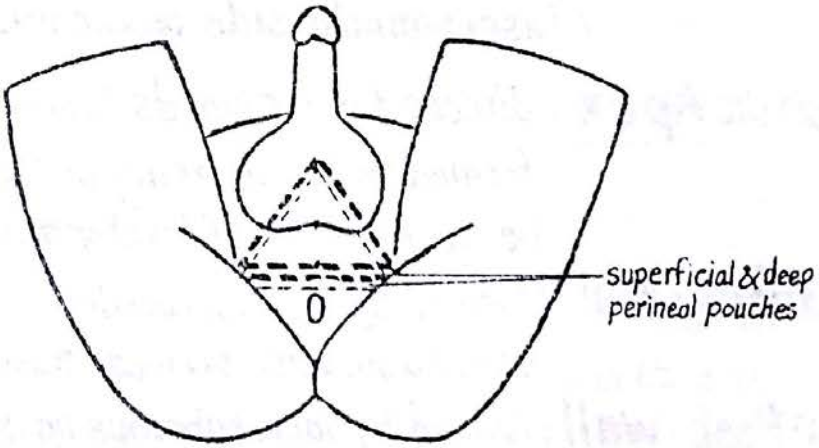
An imaginary line joining the 2 ischial tuberosities and passing just infront of the anus divides the perineum into 2 triangles — an anterior urogenital Δ. / a posterior anal Δ.

(1) Anal triangle :

- **Site** : behind the line joining the 2 ischial tuberosities.
- **Contents** :
 (1) the anal canal in the median plane (surrounded by ext. anal sphincter) : see p. 18.
 (2) 2 ischio-rectal fossae (one on each side of the anal canal) : see page 46.

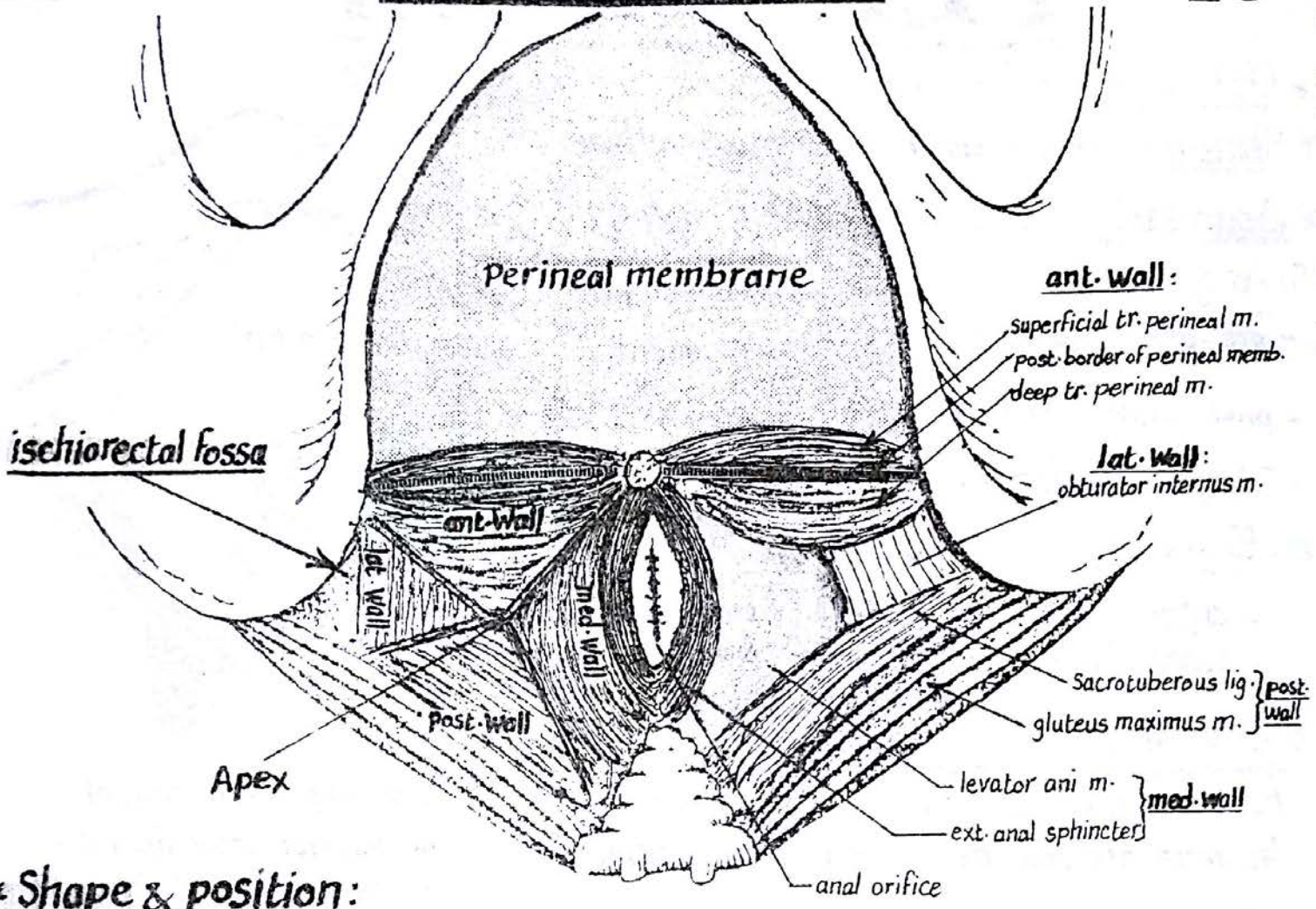
(2) uro-genital triangle :

- **site** : infront of the line joining the 2 ischial tuberosities.
- **Contents** :
 (1) the deep perineal pouch.
 (2) the superficial perineal pouch.
 (3) the urethra.
 (4) the external genital organs.



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ISCHIORECTAL FOSSA



* Shape & position:

- it is a wedge-shaped space situated one on each side of the anal canal.
- it has an apex (directed upwards), a base (directed downwards) & 4 walls (ant., post., med. & lateral).

* Dimensions:

- anteroposterior (length): 2 inches.
- side to side (width): 1 inch.
- vertically (depth): $2\frac{1}{2}$ inches

* Boundaries:

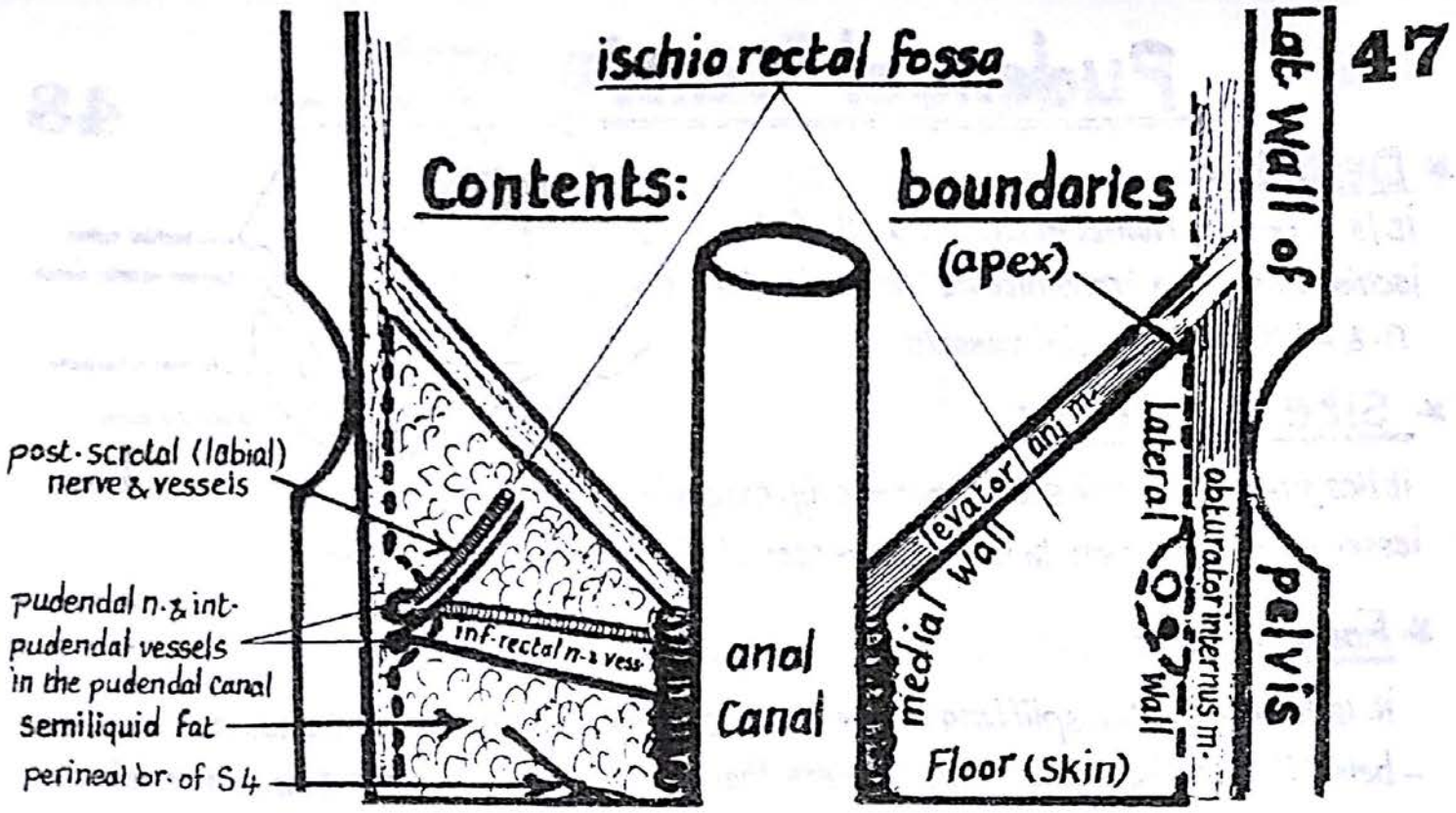
(1) the **Base**: is directed downwards & formed by the perineal skin & fascia on the side of the anal orifice.

(2) the **Apex**: directed downwards (forming the edge of the wedge). It is formed by the meeting of the medial & lateral walls of the fossa i.e at the origin of levator ani m. from the obturator fascia.

(3) **Ant. Wall**: formed by the post. border of the perineal membrane and superficial & deep transverse perineal muscles (superficial & deep to the perineal memb.)

4) **Post. Wall**: formed by sacrotuberous lig. & the lower border of gluteus maximus m.

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(5) **Lateral Wall**: (vertical) : formed by obturator internus m. & its covering fascia including the pudendal canal (p. 48).

(6) **Medial Wall**: (sloping) & formed by :
(1) levator ani muscle (in the upper 2/3).
(2) external anal sphincter (in the lower 1/3).

*Contents of the ischiorectal fossa

(1) **Semiliquid pad of fat** : allows distension of the anal canal during defaecation.

(2) **inf. rectal nerve** :
- arises from the pudendal nerve in the post. part of the pudendal canal.
- traverses the fossa from lat. to med. where it enters the ext. anal sphincter to supply it.

(3) **inf. rectal vessels** (artery & vein) :
- arise from the internal pudendal vessels in the pudendal canal.
- accompany the inf. rectal n. across the fossa to reach the anal canal & the skin around the anus.

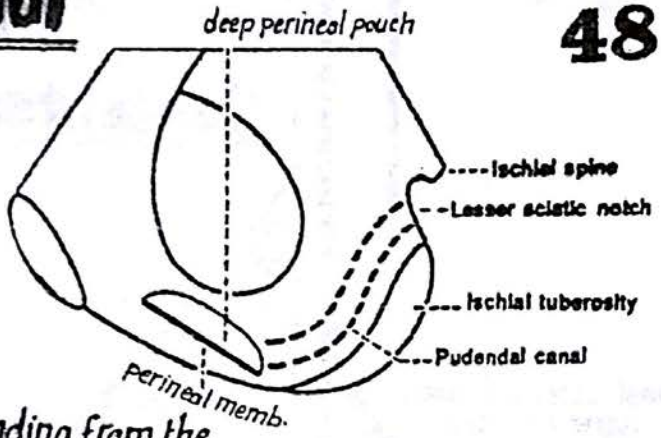
(4) **Post. scrotal (labial) nerve & vessels** :
- arise in the pudendal canal & pass forwards in the ant. part of the fossa to reach the superficial perineal pouch.

(5) **Perineal br. of S4** : pierces the coccygeus m. to enter the post. part of the fossa where it supplies the ext. anal sphincter & the skin around the anus.

(6) **Pudendal Canal & its contents** : see page 48.

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Pudendal Canal



* **Definition:**
it is a fascial tunnel in the lat. wall of the ischiorectal fossa transmitting the pudendal n. & internal pudendal vessels.

* **Site & extent:**
it lies just above the sacrotuberous lig. extending from the lesser sciatic foramen to the post. border of the perineal membrane.

* **Formation:**
it is formed by the splitting of the fascia covering the obturator internus m. – below the tendinous arch – into 2 layers that envelope the pudendal n. & int. pud. vessels.

* **Contents:**
(1) pudendal n.: in the post. part of the canal, pudendal n. gives off the inf. rectal n. and then soon divides into a larger perineal n. & a smaller dorsal n. of penis (or clitoris).
(2) internal pudendal vessels:
- the int. pudendal a. gives off its inf. rectal branch in the post. part of the canal. In the ant. part of the canal, the artery gives its scrotal (or labial) branch.
- the int. pudendal v. receives tributaries corresponding to the branches of the artery.

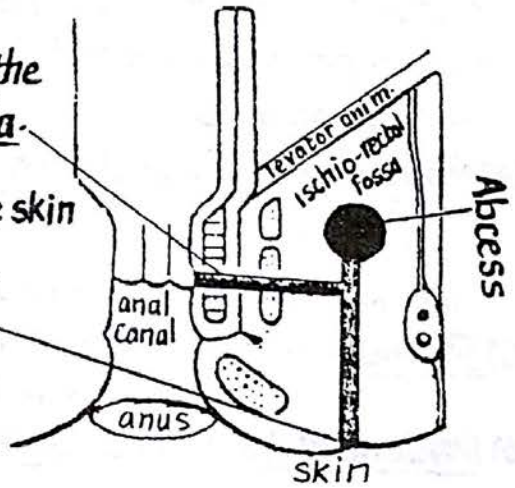
Applied Anatomy

(1) The ischiorectal pad of fat acts as a cushion-like support to the rectum & anal canal. Loss of this fat in debilitating diseases may result in prolapse of rectum.

(2) Ischiorectal abcess: may result from spread of infection to the ischiorectal fossa.

(3) if the ischiorectal abcess bursts internally into the anal canal or rectum it produces anorectal fistula.

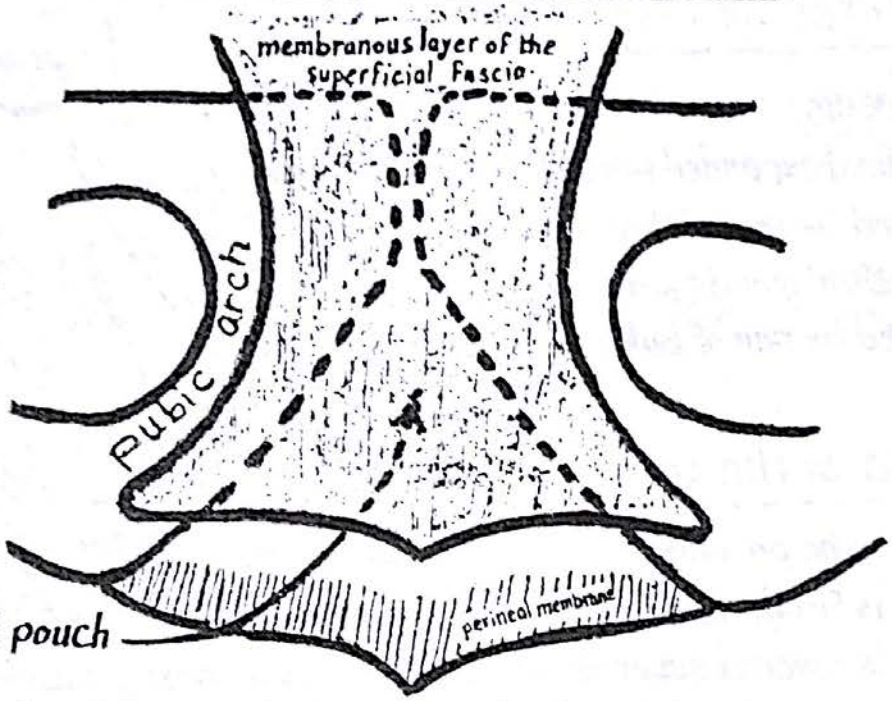
(4) if the ischiorectal abcess bursts externally to the skin it produces an external sinus.



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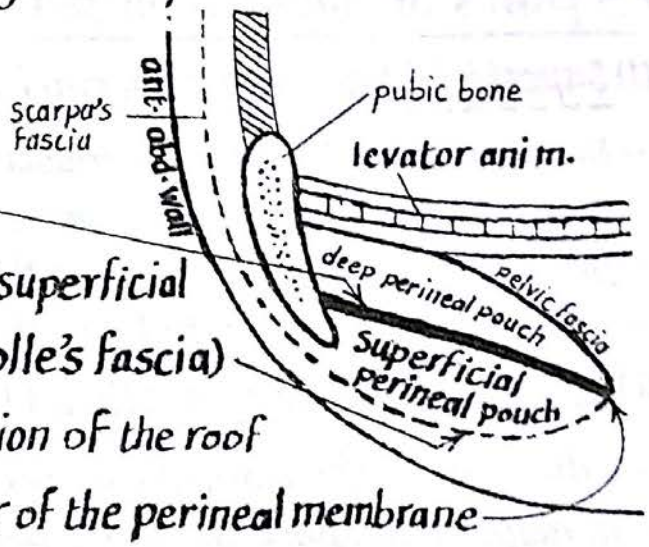
Uro-genital triangle

1-Superficial Perineal Pouch



* **Definition**: it is a fascial space in the urogenital Δ lying between the perineal membrane & the membranous layer of superficial fascia of the perineum (Colle's fascia).

* **Boundaries**:



(1) **Roof** (superiorly): Perineal membrane

(2) **Floor** (inferiorly): membranous layer of superficial fascia of the perineum (Colle's fascia)

(3) **posteriorly**: the pouch is closed by the fusion of the roof & floor along the post. border of the perineal membrane

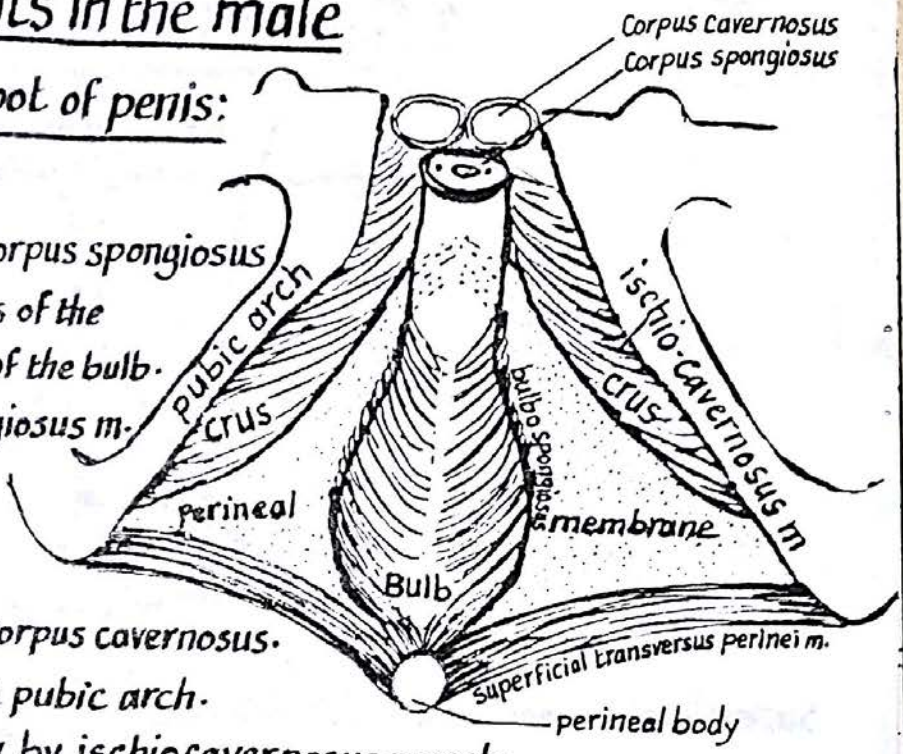
(4) **on each side** (laterally): the pouch is closed by the attachment of the roof & floor to the sides of the pubic arch.

(5) **Anteriorly**: the pouch is open & is continuous with the space deep to the membranous layer of the Superficial fascia of the anterior abdominal wall (Scarpa's fascia).

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Contents of the Superfical perineal pouch

(I) Contents in the male



(A) 3 structures forming the root of penis:

(1) **Bulb of penis:**
- it is proximal expanded part of corpus spongiosus
- it is pierced by the urethra, ducts of the bulbo-urethral glands & arteries of the bulb.
- it is covered by pair of bulbospongiosus m.

(2) **2 crura of the penis:**
- each crus is the proximal part of corpus cavernosus.
- each crus is firmly attached to the pubic arch.
- " " is covered superficially by ischiocavernosus muscle.
- " " is pierced by deep artery of penis

(B) 3 pairs of Superficial perineal muscles:

(1) **Superficial transversus perinei muscles** (Rt. & Lt.):
- they are 2 small transverse muscles (one on each side).
- each muscle arises from the pubic arch close to the ischial tuberosity.
- the 2 muscles pass medially in the post. part of the superficial perineal pouch.
- both muscles are inserted into the perineal body, they support it.

(2) **Ischiocavernosus m.** (Rt. & Lt.):
- a thin muscle which arises from ischial ramus & is inserted into the crus of the penis.
- it helps to support the erect penis.

(3) **Bulbospongiosus m.** (Rt. & Lt.):
- arises from the perineal body & from the median raphé on the bulb of the penis.
- insertion: its fibres encircle the bulb of the penis & are inserted into its wall as well as into the corpus cavernosum & dorsum of the penis.
- it contracts to compress the bulb to evacuate the last drops of urine or semen.
- it also assists in erection by compressing the deep dorsal vein of the penis.

N.B: all perineal muscles are supplied by the perineal br. of pudendal n.

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C- Vessels & Nerves :

(I) 4 arteries on each side (brs. of int. pud. a.):

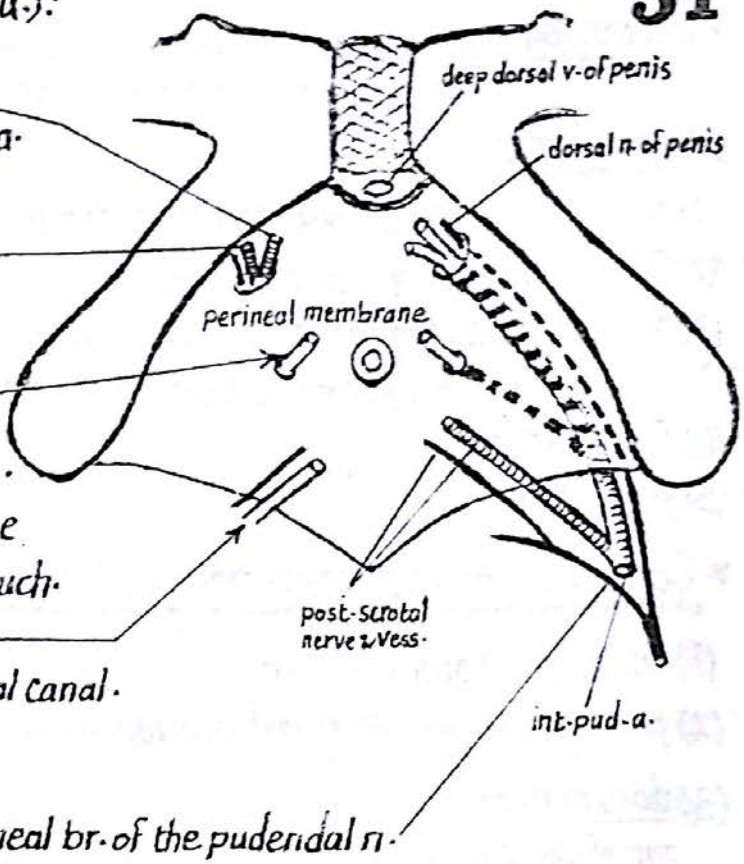
(1) dorsal artery of the penis :
- it is one of the 2 terminal brs. of int. pud. a.
- it runs on the dorsum of the penis

(2) deep artery of the penis :
- is the other terminal br. of int. pud. a.
- it pierces the corresponding crus of penis

(3) artery of the bulb of penis :
is a br. of int. pud. a. which pierces the bulb.

N.B: the above-mentioned 3 arteries pierce the perineal memb. to enter the superficial pouch.

(4) posterior scrotal artery :
arises from the int. pud. a. in the pudendal canal.



(II) 2 Nerves :

(1) post. scrotal n. : arises from the perineal br. of the pudendal n.

(2) dorsal n. of penis : one of the 2 terminal brs. of pud. n. It runs on the dorsum of penis.

(III) 1 Vein : the deep dorsal v. of penis : it runs in the middle line of the " " " & enters the pelvis to join the prostatic plexus of veins.

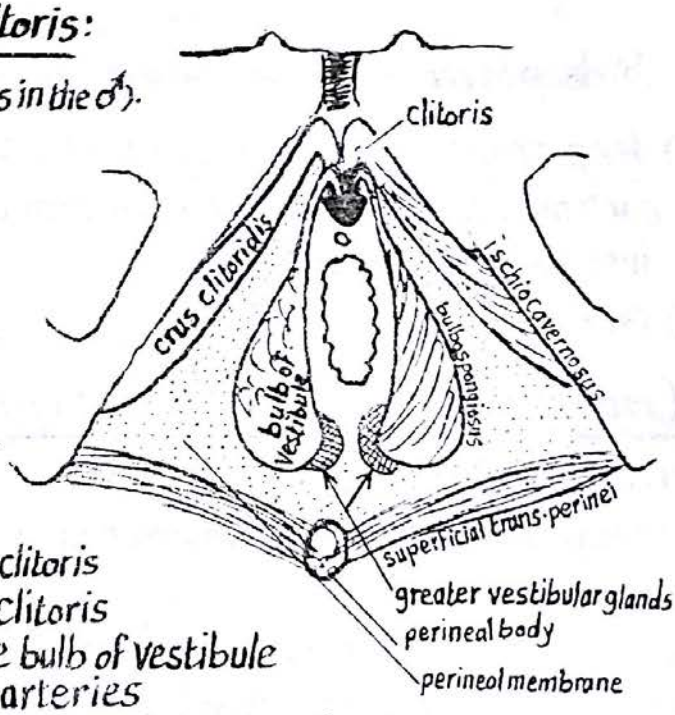
II- Contents of the superficial p. pouch in the female

(A) the structures forming the root of the Clitoris :

(1) 2 bulbs of vestibule (instead of bulb of penis in the ♂).
(2) 2 crura of clitoris

(B) 3 pairs of muscles : (as in the male) :

(1) transversus perinei muscles (Rt. & Lt.)
(2) bulbospongiosus m. (Rt. & Lt.) covering the bulb of vestibule
(3) ischiocavernosus m. (Rt. & Lt.) covering the crus of clitoris.



(C) Vessels & Nerves :

(I) arteries : brs. of int. pud. a. :
- dorsal a. of clitoris
- deep a. of clitoris
- artery of the bulb of vestibule
- post. labial arteries

(II) Nerves :
- post. labial n. (from the perineal branch of the pudendal n.)
- dorsal n. of clitoris (one of the 2 terminal branches of the pudendal n.

(D) Greater Vestibular glands

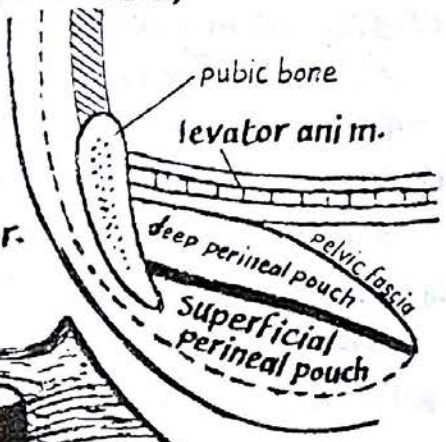
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2-Deep perineal pouch

*__Definition__: it is a completely closed fascial space situated in the urogenital Δ above (deep to) the superficial pouch. It is also called the urogenital diaphragm.

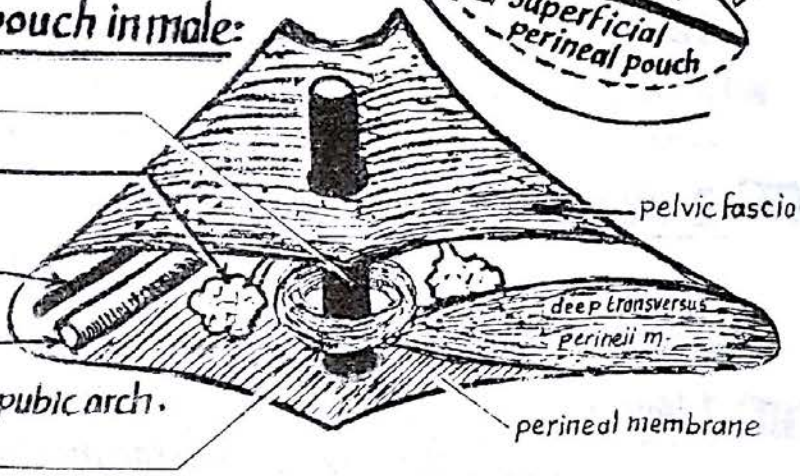
*__Boundaries:__

(1) Roof (superiorly): sup. fascia of urogenital diaphragm (pelvic fascia).
(2) Floor (inferiorly): perineal membrane.
(3) on each side (laterally): the space is closed by fusion of the roof & floor to the sides of pubic arch.
(4) Anteriorly
(5) posteriorly } the space is closed by fusion of the roof & floor.



*__Contents of the deep perineal pouch in male:__

(1) membranous urethra
(2) pair of bulbo-urethral glands
(3) dorsal n. of penis: one of the 2 terminal brs. of pudendal n.
(4) termination of int. pudenal a.: runs with dorsal n. of penis close to the pubic arch.
(5) Sphincter urethrae muscle:

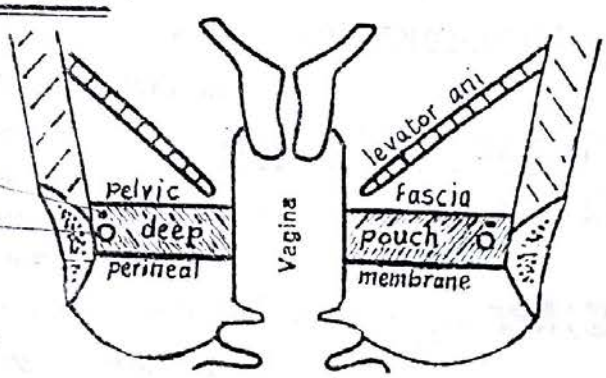


- it is a voluntary muscle sphincter filling most of the deep p. pouch & formed of:
 (a) superficial layer of anteroposterior fibres extending from the transverse perineal lig. (infront) to the perineal body (behind).
 (b) deep layer of circular muscle fibres which surround the urethra.

(6) deep transversus perinei muscles (Rt. & Lt.): in the post. part of d. pouch. Each muscle arises from the pubic arch close to the ischial tuberosity & is inserted into the perineal body.
(7) plexus of veins.

*__Contents of the deep perineal pouch in the female:__

(1) urethra
(2) vagina: its lower part traverses the d. pouch.
(3) dorsal n. of clitoris
(4) termination of internal pudendal artery
(5) Sphincter urethrae muscle.
(6) deep transversus perinei muscles (Rt. & Lt.).
(7) plexus of veins.



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Perineal Membrane

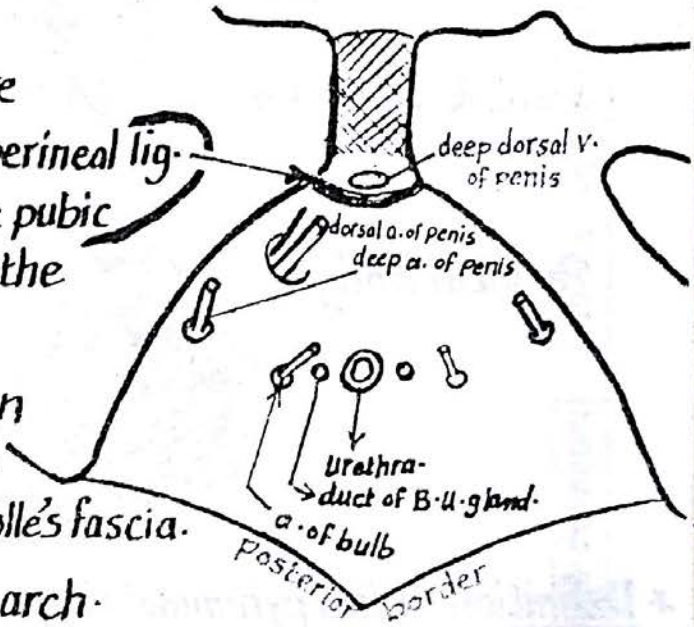
* Definition : it is a strong triangular fibrous membrane which fills the space between the pubic arches.

* Attachments :

(1) Apex (ant-border) : is directed forward towards the symphysis pubis where it is thickened to form the transverse perineal lig. which is separated from the arcuate pubic lig. by a small gap which transmits the deep dorsal vein of the penis.

(2) Base (post-border) : stretches between the 2 ischial tuberosities where it fuses with both the pelvic fascia & Colle's fascia.

(3) On each side : it is attached to the pubic arch.



* Structures piercing the perineal membrane :

(A) In the Male :

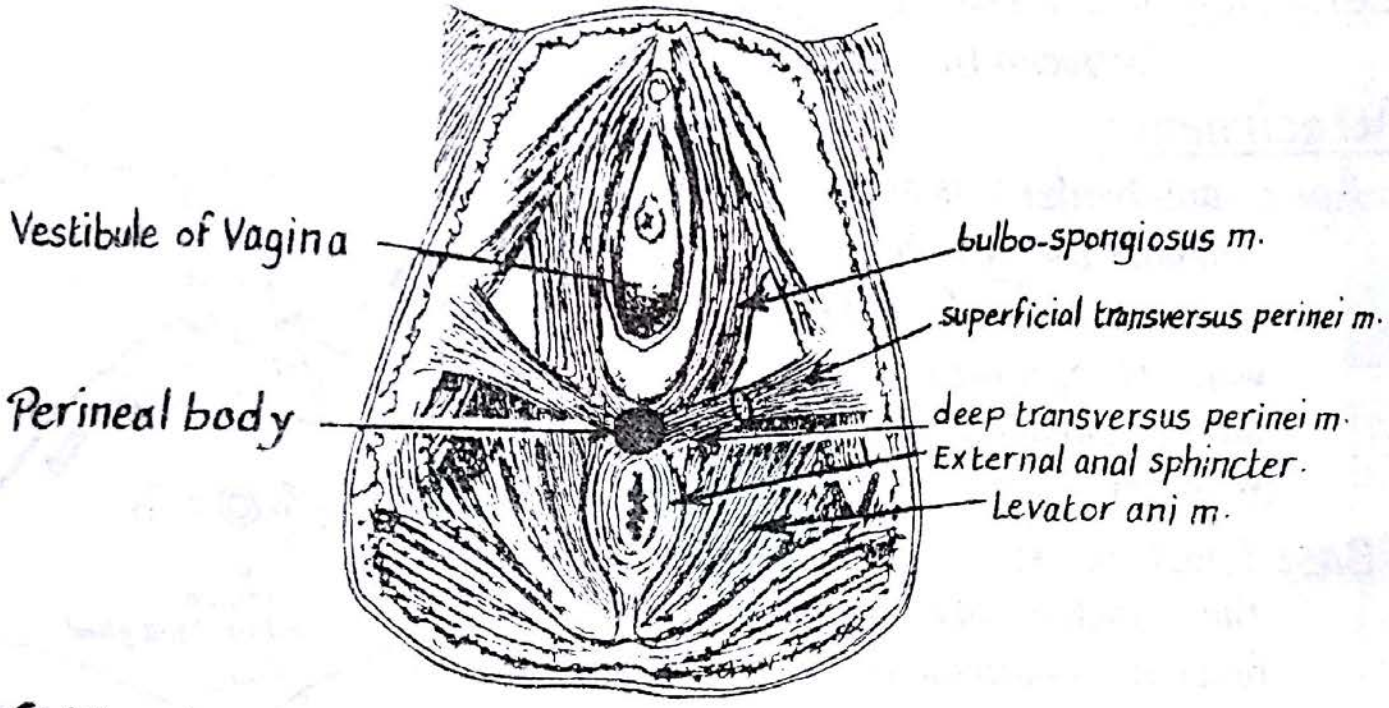
(1) urethra : pierces the membrane 1" behind & below the symphysis pubis.
(2) ducts of bulbo-urethral glands : one on each side of the urethra.
(3) artery of the bulb (one on each side) : close to the urethral opening.
(4) deep a. of penis : close to the pubic arch, halfway between apex & base
(5) dorsal a. of penis
(6) dorsal n. of penis
} close to the pubic arch, near the apex.

(B) In the Female :

(1) urethra : 1" behind & below the symphysis pubis.
(2) Vagina : pierces the membrane in the middle line just behind the urethra.
(3) artery of the bulb
(4) deep a. of clitoris
(5) dorsal a. of clitoris
(6) dorsal n. of clitoris
} pierce the membrane as their homolgues in the male.

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Perineal Body



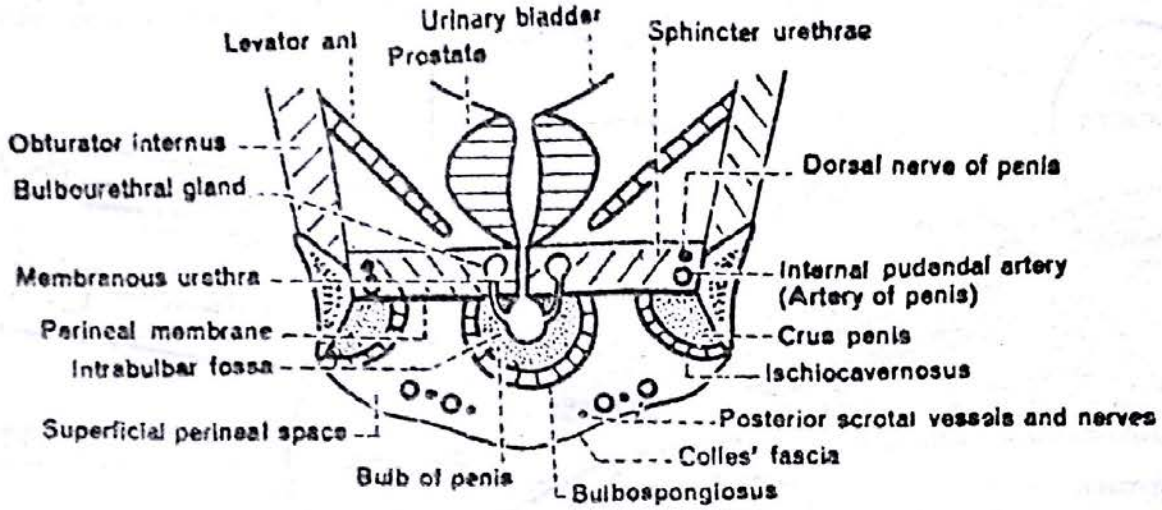
* **Definition** : it is a pyramidal fibromuscular mass lying in the middle line of the perineum at the junction between the urogenital Δ & the anal Δ.
* **Site** :- in the male : it lies between the bulb of penis & the anal canal.
 - in the female : it lies between the lower ⅓ of vagina & the anal canal.
* **Function** : it acts as tendinous centre for the attachment of several muscles:

(1) ant. fibres of levator ani (pubococcygeus part) of both sides
(2) fibres of sphincter urethrae muscle.
(3) the deep transversus perinei muscles (of both sides).
(4) Superficial " " " " " ".
(5) bulbospongiosus muscle
(6) fibres of the external anal sphincter.

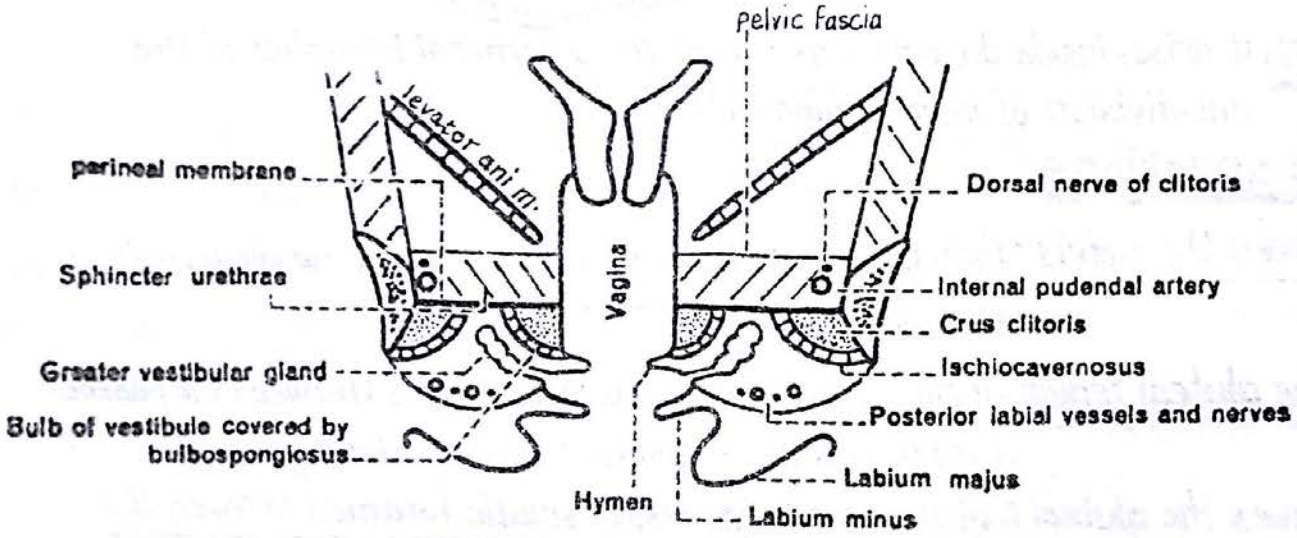
* **Applied anatomy**: the perineal body is essential for the integrity of the pelvic floor (particularly in females). Its rupture during delivery leads to widening of the gap between the anterior free borders of levator ani m. of both sides thus predisposing to the prolapse of the uterus, rectum or even the urinary bladder.

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Main differences between male & female perineum



Coronal section in male perineum



Coronal section in female perineum

(1) The deep perineal pouch (urogenital diaphragm) is split, in the female, into 2 halves by the vagina.

(2) the muscles of the deep perineal pouch are not well developed in the female & the sphincter urethrae muscle does not encircle the female urethra completely.

(3) the muscles of the superficial perineal pouch are also smaller in the female & the bulbospongiosus muscle is divided into 2 halves by the vagina

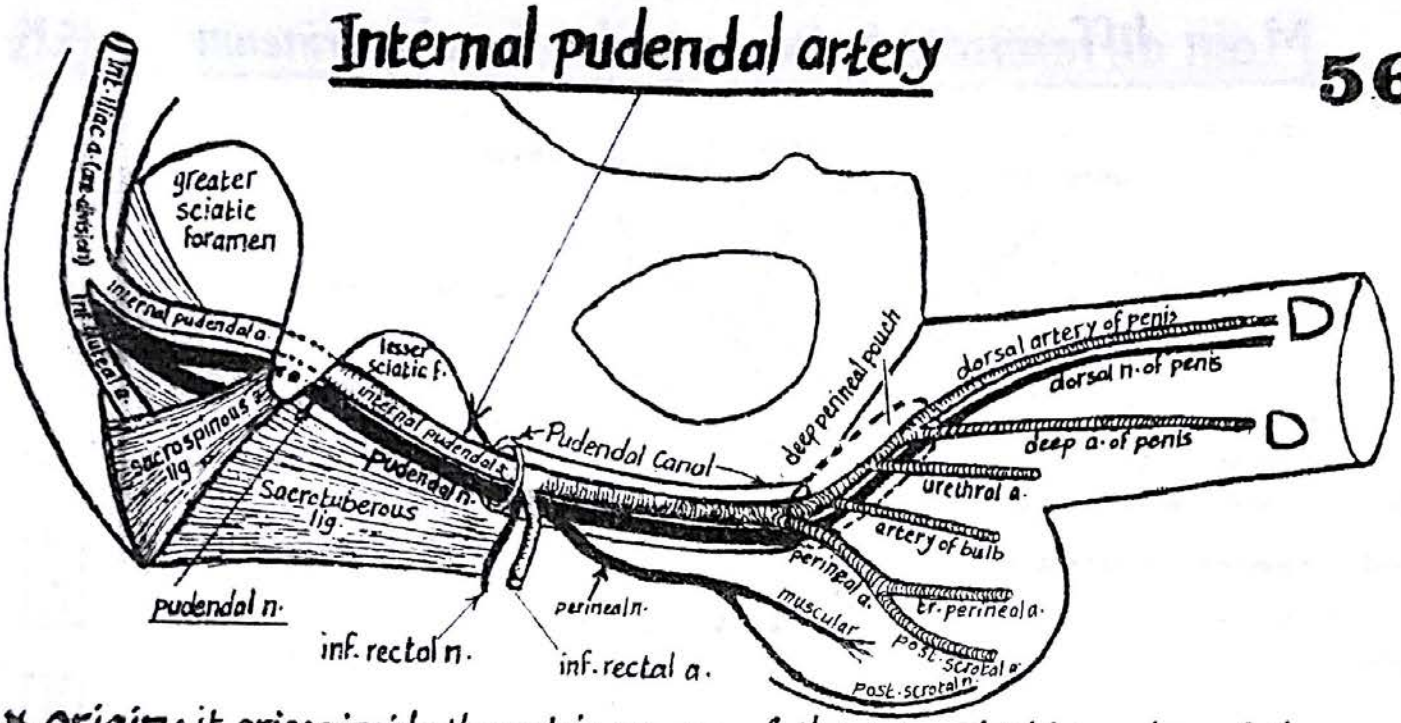
(4) the labia majora in the female are the homologues of the scrotum in the male (& labial vessels & nerves correspond to scrotal vessels & nerves).

(5) the clitoris in the female is the homologue of the penis (but is not traversed by the urethra) & its vessels & nerves correspond to those of the penis.

(6) in the female, the 2 greater vestibular glands (which lie in the superficial p. pouch) are homologous with the 2 bulbourethral glands lying in the deep p. pouch in the male.

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Internal pudendal artery



* **Origin:** it arises inside the pelvis as one of the 2 terminal branches of the ant. division of internal iliac artery.

* **Course & relations:**

(1) **it leaves the pelvis** through the greater sciatic foramen (below piriformis m. to reach the gluteal region.

(2) **In the gluteal region:** it crosses the back of the ischial spine (between the pudend. n. medially & n. to obturator internus laterally).

(3) **It leaves the gluteal region & enters the lesser sciatic foramen to reach the perineum** accompanied by the pudendal n.

(4) **it enters the pudendal canal** (in the lat. wall of the ischiorectal fossa) from its post. end then runs forwards.

(5) **then it enters the deep perineal pouch** where it ascends along the side of the pubic arch, accompanied by the dorsal nerve of penis.

* **Termination:** it ends in the deep perineal pouch a short distance below the symphysis pubis & dividing into deep & dorsal arteries of penis.

* **Branches:** (all arise in the perineum):

(1) **inf. rectal a.:** arises in the post. part of the pudendal canal. It traverses the ischiorectal fossa from lat. to med to reach the anal canal (supplying it).

(2) **Perineal a.:** arises from int. pud. a. near the ant. end of the pudendal canal then pierces the perineal membrane to enter the superficial perineal pouch where it gives 2 branches: transverse perineal a. & post. scrotal (labial) a.:

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(a) transverse perineal a. : runs transversely on the superficial transversus perinei m

(b) post. scrotal (labial) arteries : run in the superficial pouch to supply the post. part of the scrotum (labium majus).

(3) Artery of the bulb : arises in the deep perineal pouch then pierces the perineal memb. to supply the bulb of penis (bulb of vestibule in the ♀).

(4) urethral a. : pierces the perineal memb. & Corpus spongiosum to supply the urethra.

(5) Deep a. of penis : one of the 2 terminal branches of the int. pud. a. It pierces the perineal memb. & crus of penis then runs in the centre of corpus cavernosus.

(6) Dorsal a. of penis : the other terminal br. of the int. pud. a. It pierces the perineal memb. to run on the dorsum of penis lat. to the deep dorsal v.

Pudendal nerve (S 2,3,4)

* **Origin** : it arises as one of the 2 terminal branches of the sacral plexus
* **Termination** : in the pudendal canal by dividing into 2 terminal brs. : dorsal n. of penis, perineal nerve.
* **Course & relations** :

(1) it accompanies the internal pudendal a. as far as the pudendal canal, having the same course :
it leaves the pelvis through greater sciatic foramen, crosses the sacrospinous lig., enters the lesser sciatic foramen then enters the pudendal canal.

(2) it ends in the post. part of the canal by dividing into its 2 terminal branches.

* **Branches** : (all arise in the pudendal canal) :

(1) inferior rectal n. : arises in the post. part of the pudendal canal, traverses the ischiorectal fossa from lat. to med. It supplies : (a) levator ani muscle (lower surface) (b) external anal sphincter (c) anal canal below the pectinate line.

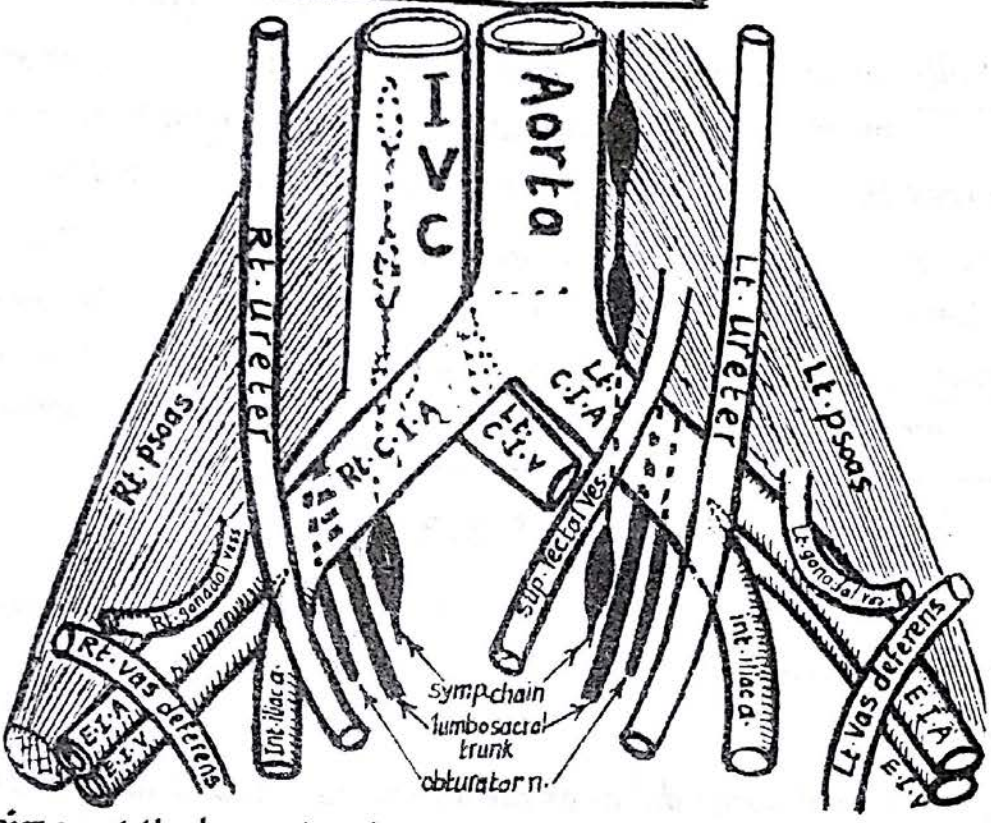
(2) Perineal n. : the larger of the 2 terminal brs. of the pud. n. It divides into :
(a) post. scrotal (labial) nerves which pierce the perineal membrane to supply the post. part of the scrotum (labium majus in the ♀).
(b) muscular brs. to supply all perineal muscles

(3) dorsal n. of penis (clitoris) : the smaller of the 2 terminal brs. of pudendal n.
- it runs forwards, first in the pudendal canal then in the deep perineal pouch between the pubic arch & the int. pudendal a.
- then it pierces the perineal memb. to reach the dorsum of the penis where it runs lat. to the dorsal a. of penis to end in the glans penis
- it supplies the skin of the body & glans penis.

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Arteries of the Pelvis

1- Common iliac artery



* **Beginning:** at the lower border of the 4th lumbar vertebra as one of the 2 terminal divisions of the abdominal aorta.

* **Course:** it descends downwards & laterally along the med. border of psoas major m.

* **Termination:** opposite the sacro iliac joint (at the level of the lumbosacral intervertebral disc) by dividing into external & internal iliac arteries.

* **Relations:**

	Rt. Common iliac artery	Lt. Common iliac artery
Anteriorly:	(1) parietal peritoneum (2) Rt. ureter (crosses the end of the artery) (3) symp. fibres passing to the superior hypogastric plexus.	(1) parietal peritoneum. (2) Lt. ureter (crosses the end of the artery) (3) symp. fibres passing to the superior hypogastric plexus. (4) Sup. rectal vess. crossing the middle of the a.
Posteriorly:	(1) 4th & 5th lumbar vertebrae. (2) Rt. symp. chain, obturator nerve & lumbosacral trunk. (3) Beginning of the I.V.C.	(1) 4th & 5th lumbar vertebrae. (2) Lt. symp. chain, obturator nerve & lumbosacral trunk.
Medially:	Lt. common iliac vein	Lt. common iliac vein
Laterally:	(1) Rt. psoas (2) Rt. common iliac v.	(1) Lt. psoas major m.

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2- External iliac artery

* **Origin**: arises opposite the sacro-iliac joint as the larger of the 2 terminal branches of the common iliac artery.
* **Termination**: it leaves the pelvis & enters the thigh by passing deep to the inguinal lig. at the midinguinal point.
* **Course**: it passes forwards, downwards & laterally along the medial side of the psoas major muscle (on the pelvic brim).
* **Relations**:

(1) Anteromedially:
(a) it is covered by peritoneum which separates the artery from the terminal part of ileum (on the Rt. side) & sigmoid colon & ileum (on the Lt. side).
(b) it is crossed by: (1) the ureter (crosses the artery at its beginning).
(2) vas deferens (in the male)
(3) ovarian vessels & round lig. of uterus (in the female).

(2) Laterally: psoas major muscle.

(3) Posteriorly: External iliac vein.

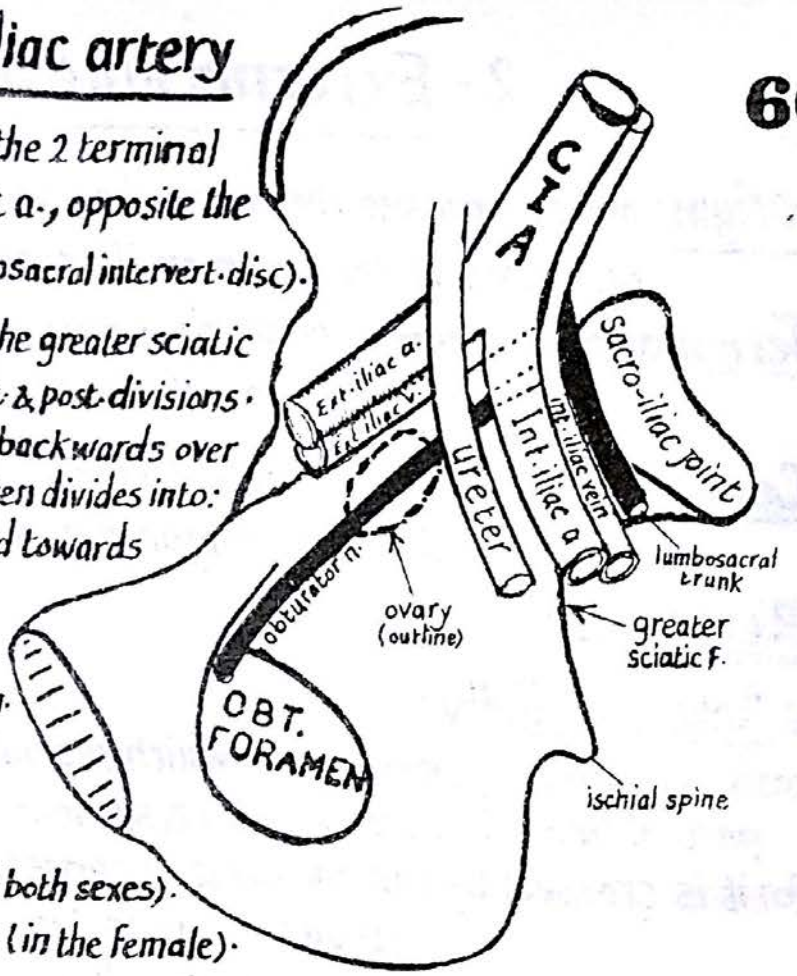
* **Branches**:

(1) Inferior epigastric a.: see Abdomen (page 13).

(2) Deep circumflex iliac artery:
- arises from the external iliac a. just above the inguinal lig.
- passes laterally & upwards behind the inguinal lig., towards the ant. sup. iliac spine
- then it runs along the inner lip of the iliac crest where it pierces the transversus abdominis & passes between it & the int. abd. oblique muscle.
- Branches:
(1) muscular branches to the muscles of ant. abd. wall.
(2) ascending br.: ascends between the transversus abdominis & int. abd. oblique to anastomose with the lumbar arteries & musculophrenic a.
(3) anastomotic br.: shares in the anastomosis around the ant. sup. iliac spine.

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3- Internal iliac artery



* **Origin**: it arises as the smaller of the 2 terminal branches of the common iliac a., opposite the Sacro-iliac joint (level of lumbosacral intervert. disc).
* **Termination**: at the upper margin of the greater sciatic foramen by dividing into ant. & post. divisions.
* **Course**: it descends downwards & backwards over the lat. pelvic wall for 4 cm then divides into:
 (1) ant. division: continues downward towards the ischial spine.
 (2) post. division: runs backwards towards the greater sciatic foramen.

* Relations:

(A) Infront:
(1) ureter: parallel to the artery (in both sexes).
(2) ovary & lat. end of the uterine tube (in the female).

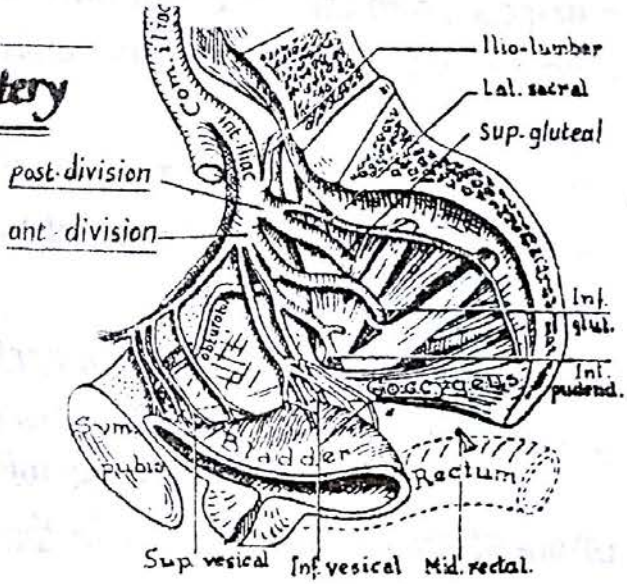
(B) Behind:
(1) internal iliac vein
(2) lumbosacral trunk } parallel to the artery.
(3) Sacro-iliac joint.

(C) Laterally:
(1) external iliac v.: separating the artery from psoas major m.
(2) obturator n.: separating the artery from the lat. pelvic wall.

(D) Medially: peritoneum, separating the artery from:
(1) terminal part of ileum: on the Rt. side.
(2) Sigmoid colon: on the Lt. side.

* Branches of int. iliac artery

Post-division	Anterior division	
(1) ilio lumbar a.	(1) obturator a.	parietal brs.
(2) lat. sacral aa.	(2) int. pudenal a.	
(3) sup. gluteal a.	(3) inf. gluteal a.	
(all are parietal brs.)	(4) superior vesical a.	visceral brs.
	(5) inf. vesical (Vaginal in ♀)	
	(6) middle rectal a.	
	(7) uterine a. (in the ♀)	



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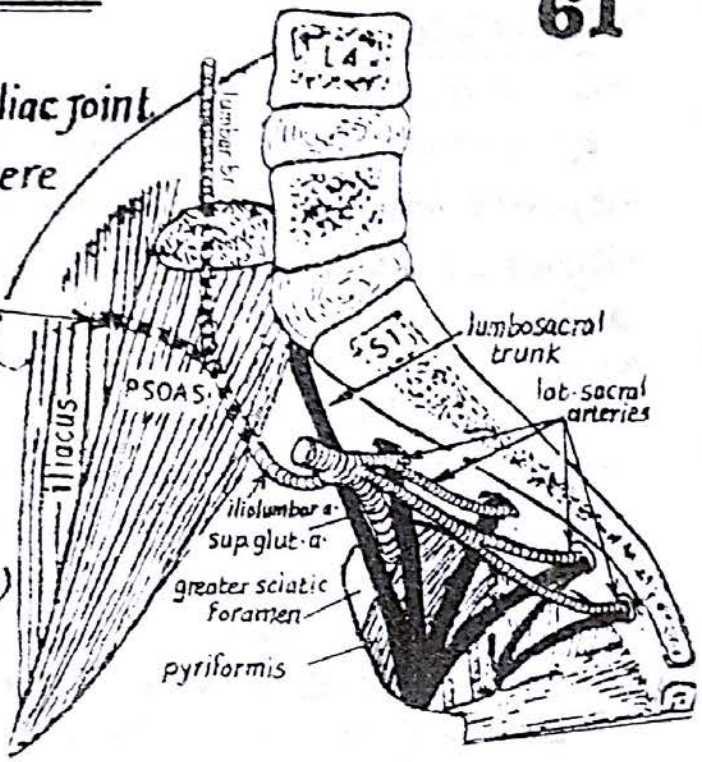
(A) Branches of the post-division

(1) Iliolumbar a.

- passes upwards & laterally infront of the sacro-iliac joint.
- then it disappears deep to the psoas major m. where it divides into 2 branches

(a) iliac br.: runs laterally deep to iliacus muscle (supplying it). It anastomoses with the iliac br. of obturator a. & shares in the anastomosis around the ant. sup. iliac spine.

(b) lumbar br.: ascends between psoas major & quadratus lumborum (supplying both muscles) & anastomoses with the 4th lumbar artery.



(2) Lateral sacral arteries:

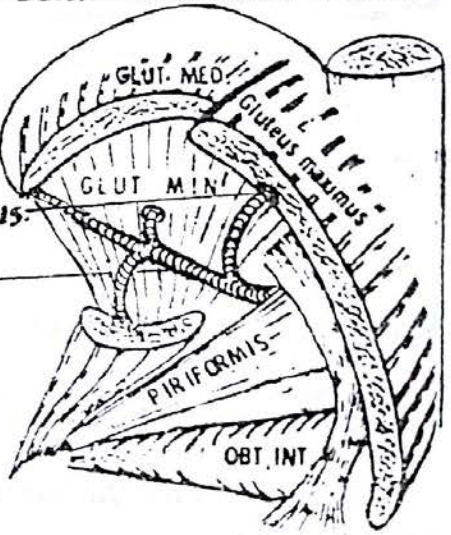
- they are 2 arteries which pass medially towards the ant. sacral foramina where each artery divides into 2 branches
- the resulting 4 arteries enter the 4 ant. sacral foramina to supply the contents of the sacral canal then emerge from the post. sacral foramina to supply the muscles & skin on the back of sacrum.

(3) Superior gluteal artery:

- it is the continuation of the post-division of int. iliac a. (the largest branch)
- it passes between the lumbosacral trunk & the 1st sacral n. or between the 1st & 2nd sacral nerves.
- then it leaves the pelvis by passing through the greater sciatic foramen above piriformis muscle to reach the gluteal region.
- It ends in the gluteal region by dividing into:

(a) superficial br. enters the deep surface of gluteus maximus.

(b) deep br.: passes laterally deep to gluteus medius towards the ant. sup. iliac spine. It supplies gluteus medius & minimus & shares in the iliac anastomosis around the A.S.I. spine.



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(B) Branches of the ant. division

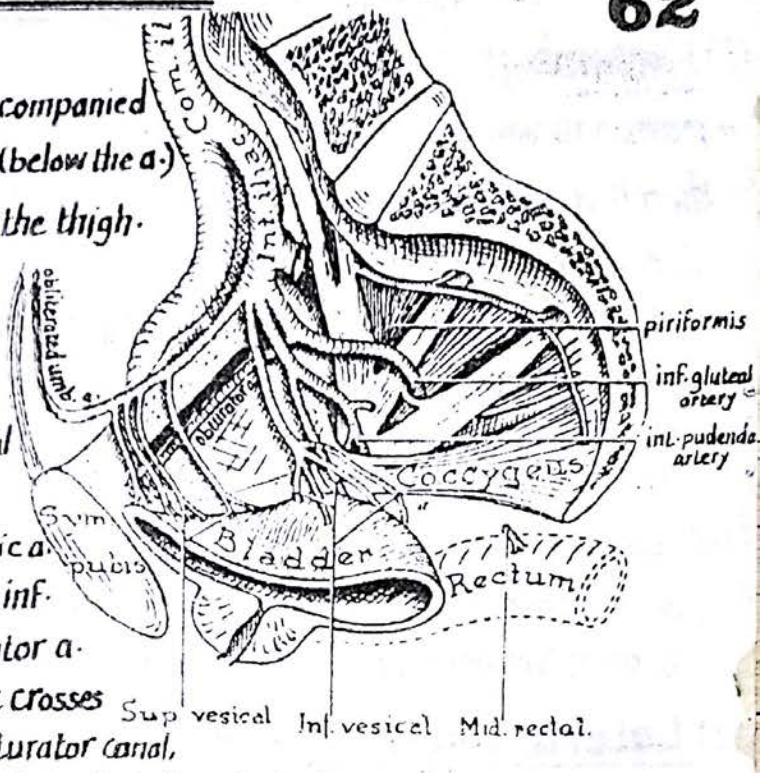
(1) Obturator a.

- it runs forwards on the lat. pelvic wall, accompanied by obturator n. (above the a.) & obturator vein (below the a.)
- it passes through the obturator canal to enter the thigh.
- it gives the following branches in the pelvis:

(a) iliac brs. to the iliac fossa.

(b) pubic br.:
- arises just before the a. reaches the obt. canal
- it ascends behind the sup. pubic ramus to anastomose with the pubic br. of inf. epigastric a.

N.B: in 20-30 % of people, the pubic br. of the inf. epigastric a. is large & replaces the obturator a. & is called the **Abnormal obturator** a. It crosses the base of the lacunar lig. to reach the obturator canal.



(c) Vesical br. to the urinary bladder (may replace the inf. Vesical a.).

(2) Inferior gluteal artery:

- it is the larger of the 2 terminal brs. of the ant. division of int. iliac a.
- it passes between the 1st & 2nd (or between the 3rd & 4th) sacral nerves.
- it leaves the pelvis by passing through the greater sciatic foramen, below piriformis.
- it enters the gluteal region where it supplies the gluteal muscles & shares in the formation of iliac, cruciate & trochanteric anastomoses.

(3) Internal pudendal artery:

it is the smaller terminal br. of the ant. division. It is described in detail in page 56.

(4) Obliterated umbilical a.

- it passes forwards on the side wall of the pelvis then ascends on the back of the ant. abdominal wall as far up as the umbilicus.
- its proximal part (1-2 cm) is patent & gives of 2-3 Sup. Vesical arteries to supply the urinary bladder & the artery of vas deferens
- its distal part is obliterated & called the lat. umbilical lig.

(5) Inferior Vesical a.

- it supplies the base of the urinary bladder, lower part of the ureter, seminal vesicles & prostate.
- in the female, this artery is replaced by the Vaginal artery.

(6) Vaginal a.: runs forward & medially on levator ani m. then descends on the vagina to share in the formation of the azygos arteries of vagina (p. 44).

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(7) **Uterine a.** : see page 42

(8) **Middle rectal a.**

- runs medially to reach the middle part of the rectum. It supplies the rectum & gives branches to the seminal vesicle & prostate (in the male) & to vagina (in the female).

Median Sacral artery : See abdomen page 95

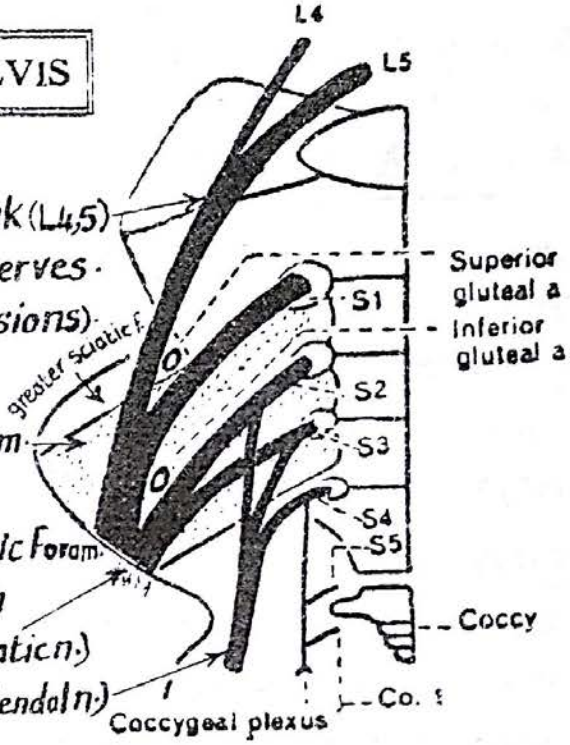
NERVES OF THE PELVIS

1- SACRAL PLEXUS

***Formation**: it is formed by the lumbo-sacral trunk (L4,5) & the ventral rami of S1,2,3 & upper part of S4 nerves. (Each of these roots divides into ant. & post. divisions).

***Site & Relations:**

- it lies on the post. pelvic wall infront of piriformis m. and behind the internal iliac vessels & the ureter.
- the roots converge towards the lower part of greater sciatic foram. where they unite forming a triangular band which ends by dividing into : (a) larger terminal band (sciatic n.)
 (b) smaller " " (pudendal n.)



***Branches of the plexus:**

(A) Branches from the roots only :

(1) nerve to piriformis (S1,2)
(2) Perforating cutaneous n. of thigh (S2,3)
(3) Pelvic splanchnic n. (parasympathetic): S2,3,4.
(4) perineal branch of 4th sacral n.:
(5) Pudendal n. (see page 57).

(B) Branches from anterior divisions:

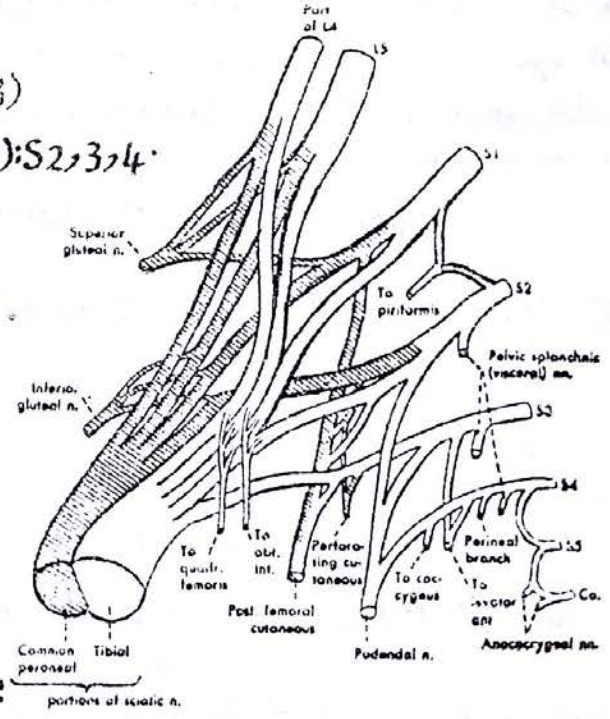
(1) n. to quadratus femoris (L4,5, S1).
(2) n. to obturator internus (L5, S1,2).

(C) Branches from posterior divisions:

(1) Superior gluteal n. (L4,5 & S1).
(2) inferior gluteal n. (L5 & S1,2).

(D) Branches from both ant. & post. divisions:

(1) post. cut. n. of thigh (post. div. of S1,2 & ant. div. of S2,3)
(2) Sciatic n. : common peroneal portion (post. div. of L4,5, S1,2), tibial portion (ant. d. of L4,5, S1,2,3).



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2- Coccygeal plexus

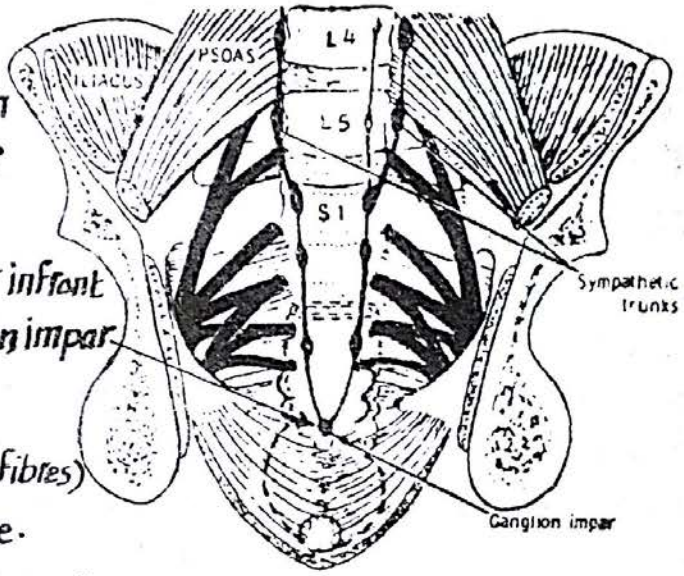
- it is a small plexus lying infront of coccygeus m. & formed by { br. of ant. ramus of S_4 / ant. ity ramus of S5 / the coccygeal n.
- it gives branches that pierce the sacrotuberous lig. to supply skin around the coccyx.

(3) Pelvic part of the sympathetic chain

- The sympathetic chain (one on each side) enters the pelvis by crossing infront of ala of sacrum & deep to the common iliac vessels. It contains 4 ganglia.

*Course & relations:

- it descends on the pelvic surface of the sacrum (just med. to ant. sacral foramina) & behind the sigmoid colon & rectum.
- the Rt. & Lt. chains converge & unite together infront of coccyx ending in a small ganglion called ganglion impar.



*Branches:

(1) grey rami communicantes (post. ganglionic fibres) to all the sacral nerves & the coccygeal nerve.

(2) branches from the upper 2 ganglia to the inferior hypogastric plexus.

(3) Vascular branches to:

(a) the arteries of the perineum (reaching them via the pudendal n.)

(b) » popliteal a. » » Lower limb (» it via the femoral n.)

N.B: the symp. vascular brs. to femoral a. arise from the lumbar part of symp. chain.

(4) Inferior hypogastric plexuses

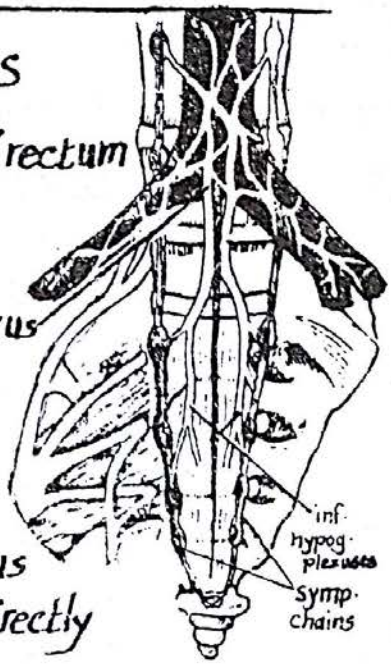
*Site: they are Rt. & Lt. plexuses which lie on each side of rectum & other pelvic organs

*formation: it is formed by:

(1) the 2 hypogastric nerves from the sup. hypogastric plexus

(2) branches from the upper 2 sacral symp. ganglia.

(3) parasympathetic fibres from the pelvic splanchnic nerve (S2,3,4).



*Branches: each of the Rt. & Lt. inf. hypogastric plexus gives branches to the pelvic viscera, reaching them either directly or along the brs. of the internal iliac a.

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